INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

Scientific Proceedings of the Eleventh General Meeting[1]
Hotel Stevens, Chicago, Illinois
March 18 and 19, 1933

Compiled by WILLIAM J. GIES, F.A.C.D., *Secretary*[2]

Columbia University, New York City

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I. Introduction

When early in March all banks in the United States were closed by order of President Roosevelt, the plans for the eleventh general meeting of the International Association for Dental Research had been perfected. In accordance with custom since 1928, the meeting was to have been coördinated, by agreement, with the annual meeting of the American Association of Dental Schools, and was scheduled to be held at the Hotel Stevens, Chicago, Ill., March 18–19, that of the School Association to follow on March 20–22. On March 6 we were informed that, owing to the financial stringency created by the "bank holiday,"

[1] The introduction corrects some details on this page. The President's address, and abstracts of the papers, at the general meeting in 1932 were published in the *Journal of Dental Research*: 1932, xii, pp. 412–565; June.

[2] Most of the abstracts have been prepared by those who presented the corresponding papers. All revisions have been verified by the authors.

the meeting of the American Association of Dental Schools had been indefinitely postponed. The General Secretary of the International Association for Dental Research, believing that the "bank holiday" would be practically terminated before the date scheduled for the meeting of the Research Association, and feeling that if possible the meeting should be held as scheduled, on March 7 proposed to the North American members of the Council several alternatives as to procedure. These members of the Council in immediate response, by a vote of 13 to 1, authorized the Chicago Section to decide, *on March* 14, whether the meeting of the Research Association should be conducted independently, as scheduled on the official program (printed copies were then in the hands of all members in North America), or as indicated below. The Council also requested the Chicago Section to telegraph the Section's decision, on March 14, to the secretaries of all the sections in Canada and the United States. On March 14 the Chicago Section voted that the meeting should not be held on March 18–19 as scheduled. The *alternatives* for which the North American members of the Council had voted, 13 to 1, included the following substitute procedure (1 and 2), which then was followed:

(1) A *nominal* meeting of the Association was held on March 18, under the auspices of the Chicago Section, at the Dental School of Northwestern University. At this meeting of the Association all the addresses and papers designated on the official program (115 units) were formally declared read by title.

(2) This nominal meeting of the Association was concluded by unanimous adoption of a motion to transfer the executive proceedings to an *adjourned* meeting of the Association to be held under the auspices of the New York Section. The adjourned meeting was held at the Western Universities Club in New York City on May 25. This plan of procedure, in the emergency, appeared to be better than an *indefinite* postponement, especially as there was then no indication of the probable selection of dates for the postponed meeting of the American Association of Dental Schools.

The present account of the proceedings preserves the outline of the official program, as it had been announced to the members before the financial crisis created the exceptional emergency that upset the plans. The President's address and the abstracts of the papers are presented

here exactly as they would have been published, if the sessions had been held on March 18 and 19 as originally scheduled. A statement of executive proceedings, in extension of the data on page 254 of this issue, will be published in the supplement, in the number for December, 1933.

II. President's Address[3]

CERTAIN TRENDS IN DENTAL RESEARCH

R. W. Bunting, D.D.S., D.D.Sc., F.A.C.D., Dental School, University of Michigan, Ann Arbor, Mich.

In the approach to a discussion of research in dentistry one is confronted with that debatable question, What is research? There are those who hold that any activity by which additions are made to human knowledge, of whatever sort, is research. The accumulation of data often unrelated to the basic principles involved, the invidious practice of sending out questionnaires (that lowest form of indoor sport to which so many are addicted), the amassing of clinical statistics, and the invention of new apparatus and methods of procedure or practice, have all been characterized as research. There is, however, a growing feeling that this shibboleth which has dignified so many diversified and questionable activities in every department of human endeavor should be more strictly defined, and limited to those investigations which conform to the generally accepted methods of scientific procedure. Research should embrace only those studies which are founded on a full comprehension of all available knowledge underlying the question, and are carried out in an orderly and purposeful attempt to solve the unknown. It may be characterized as a scientifically organized expression of that insatiable quality of certain human minds—the desire to know. In his book on universities, Abraham Flexner answers the question, what is research, by saying: "It is a quiet, painstaking effort on the part of an individual himself, not through someone hired by him, although intellectual coöperation is, of course, not barred, an effort, I say, to reach the truth, the severest that the human mind with

[3] Number 56 in the program sequence (page 213). The address was scheduled for delivery as the concluding phase of the scientific proceedings, and before the installation of Dr. Edward H. Hatton as President for 1933–34.

all available apparatus and resources, is capable of making at the moment."

The progress of dentistry has been marked by three general types of investigation: first, that of invention; second, clinical observations and statistical studies; third, truly scientific research into the various problems in the dental field. In the early days, practitioners of dentistry were largely opportunists; men who had learned that they might contribute to the comfort and happiness of mankind by the performance of certain mechanical and restorative procedures on teeth which had been damaged by disease. For the most part these practitioners had no training in the basic sciences. They were artisans who were skillful in performing delicate and minute operative procedures on the teeth. The ideal which they held highest in their professional activities was that of the preservation of every tooth in its full function and esthetic qualities, and the restoration of all dental structures which had been lost by disease, irrespective of all other considerations. The loss of any tooth, no matter how badly mutilated or diseased, was considered to be evidence of professional incompetency and confession of failure. The progress of dentistry during these years was largely confined to a development of the mechanical arts, and consisted of the invention and discovery of newer forms of apparatus and more refined technical procedures, and the amassing of clinical observations relative to dental diseases. These developments were largely empirical in type and almost wholly lacking in scientific method. Notable exceptions, however, are found in the work of W. D. Miller, J. L. Williams, Howard Mummery, G. V. Black, and a few others who, with the meager knowledge and facilities of those early days, made outstanding scientific contributions to the literature of dentistry, many of which are accepted today as established facts. Investigations in the field of dentistry were carried on almost wholly by dentists, as there was little general interest in the problems of the oral field.

A complete change in the status of dentistry and its relationship to human welfare was inaugurated by the pronouncement of Dr. William Hunter in 1910, who forcibly called the attention of both medicine and dentistry to the fact that diseases of the mouth and the things done in the name of dentistry bear a very definite relationship to general health. This pronouncement so stirred the interest of both pro-

fessions that there evolved a complete change of attitude, in which dentists began to think in terms of general health and physicians began to realize that the diseases of the mouth were of considerable importance. As a result of this change of attitude, scientifically trained individuals in various fields of medical science began intensive studies of many of the problems of dental pathology. The events which followed were most significant. There arose a wholly new concept of the functions of dentistry, and a realization of the need for intensive study of the important health problems in the oral field. As a result of the efforts in this direction there has come a complete metamorphosis of the profession of dentistry by which it has been changed from a pure art or trade to an important branch of medical science.

In this evolutionary process there were several significant factors. The first, that of the Hunterian pronouncement, was followed by a number of activities all of which played their part in the future course of events. Among these was that frequently quoted statement of Charles Mayo: "The next great step in preventive medicine must be made by dentists." The activities of Dr. Weston A. Price during these years played a very important part. He traveled throughout the country calling the attention of dentists to the relation of dental disease and dental procedures to general health, and appealed for the establishment of well-founded research. He succeeded in awakening the dental profession to the need for research to the extent that the American Dental Association voted one dollar per year per member for the maintenance of research workers in the field of dentistry, and established the Research Council of that Association. During the early days of this period Dr. Price did more than anyone else to stimulate a research attitude in the minds of dentists. A strong influence was also exerted by many outstanding men in the medical profession, among whom were Rosenau, Mayo, Billings, Irons, and Hayden, who gave considerable thought to the problem of oral infection.

In the years that followed there were numerous attempts on the part of dentists to study the problems of oral pathology. Many of these investigations were poorly organized, not well-founded, and attended by considerable duplication of effort. Out of the chaos consequent upon this frantic search for the truth some degree of order and stabilization was effected through the efforts of Dr. William J. Gies

who in 1920 organized the International Association for Dental Research to bring the workers in dental research to a better mutual understanding of the problems and the research activities. A year earlier he founded, and has carried on until the present time, the *Journal of Dental Research*, a dignified and scholarly attempt to present the worth-while achievements in dental science in an acceptable literary form. The activities of Dr. Gies in these directions have been a source of stimulation and guidance to research in dentistry, and have been of untold value in the development of a scientific attitude on the part of the dental profession.

In a survey of the scope of recent activities in dental research, as recorded in the proceedings of the annual meetings of this Association, it will be found that the major interest has been given to the biologic sciences and the pathologic processes related to the oral field. These outnumbered the contributions to the operative and mechanical phases of dentistry more than four to one. They consisted of studies of histology, anatomy, and pathology of the oral tissues, salivary and urinary analyses, nutrition, and methods of research. In the field of operative and mechanical dentistry the contributions have been few in number. These have been related to operative and prosthetic procedures, a study of filling materials, the treatment of dental and oral diseases, orthodontia, and surgery. Perhaps, in view of the great need for basic studies in the biologic phases of dentistry, this unequal distribution in the two fields has been justified. It should be borne in mind, however, that the major portion of dental practice is mechanical, engineering in type, and that in the practical phases of our profession there are many unsolved problems demanding true scientific investigation. These problems in the engineering and constructive phases of dentistry should not be disregarded, but should be subjected to the same type of scientific inquiry as that applied to the biologic sciences. If dentistry is to be a truly scientific profession the mechanical and biologic aspects must develop side by side, equally well-founded on a broad knowledge of the basic sciences and expanded through organized research. In the future there should be greater appreciation of the application of scientific methods to the mechanical and operative phases of dentistry. If the scientific advancement of dentistry of the future is to be solely biologic, the practical phases will be relegated

to an inferior position, and dentistry as we know it today will lose much of its prestige and recognition as a public health-service.

As we review the various diseases of the mouth with which dentists are constantly dealing, we find that almost without exception they are quite specific and unusual disease processes. The tissues of the mouth are subject to the same general laws of metabolism and of pathologic deviation therefrom; but, owing to the specific anatomic and physiologic structure and functions of the oral and dental tissues, many unique problems arise in the study of the diseases that affect them. Where else in the body do we find hard tissues being destroyed by acids of fermentation as in dental caries? Where else in the body do we find infectious and degenerative processes involving an articulation of the nature of gomphosis, such as occurs in pyorrhea? Where else in the body do we find minute infectious areas which seemingly are so significantly related to bodily health as those that occur at the root ends of teeth? Where else in the body do we find conditions which resemble the erosion and abrasion of teeth, in which hard substances of the body are destroyed without commensurate replacement? The unique character of the diseases in the dental field has made the analysis and the solution of the various pathologic problems very difficult. The attempt to correlate them to other better-known conditions without due consideration for their individual characteristics has led to misapprehension and error, and has greatly delayed the final solution of our chief problems.

Many notable contributions to our knowledge of these subjects have been made in the past, through which we have obtained a working knowledge of the more outstanding phases of the various disease processes. It cannot be said, however, that the final word has been spoken in any of these studies, for in the analysis of practically every disease in the oral field many factors are still unknown. It has become apparent that the final solution of these problems will require types of research which may go far afield into the various allied sciences, quite outside of the special realm of dentistry. The study of dental caries will involve intensive researches in bacteriology, immunology, biochemistry, and nutrition. The study of pyorrhea will lead to many intricate phases of medical science. The problems in orthodontia are definitely based on the biologic sciences, pediatrics, engineering, and

fine arts. So also researches in operative dentistry and in prosthetics will involve very intensive studies of chemistry, metallurgy, and engineering, combined with studies in metabolism, colloid chemistry, and fine arts. An example of what has been said is seen in the recent advancement in the study of mottled teeth. The discovery of the direct cause of these dental stigmata was attained not by dentists but by water analysts and biochemists. Since it has been determined that very minute proportions of fluorine in the water supply are manifestly responsible for this disturbance, the attention of those who desire to correct it has been focussed on the water supply of various communities which are thus affected. The obvious corrective measure is a problem in water-works engineering. In certain communities, however, no other source of water is available. In such cases the next step may be the discovery of some means by which fluorine can be precipitated out of solution or combined into some innocuous form. This will be accomplished only through the most intricate and complicated forms of chemical research.

Thus we see that many of the problems in dentistry have gone outside of the scope of that special field, and far beyond the ability of individual dentists to execute in all of their details. There are few dentists with a training of sufficient breadth in the basic sciences to enable them to carry their problems into the several fields of allied science. There are no workers in the field of pure science who are sufficiently acquainted with dental problems to approach their study unaided. Therefore, comprehensive attacks on the problems in the dental field in the future should be made in the form of group studies in which scientifically trained dentists are closely associated with competent workers in those fields of pure science in which the problem lies. We are not unmindful of the fact that in the early days very definite accomplishment was made by the individualistic efforts of a few earnest students of dentistry. When we consider the complexity of the problems in dental pathology and dental practice, and when we realize how short a time they have been studied intensively and how small has been the number of workers engaged in this form of activity, we may point with pride to the accomplishment thus far attained. Despite the many years that medicine has studied its problems, and

the large numbers of investigators and the vast sums of money made available for medical research, there still remain great tracts of the unknown to be explored in the realm of medical science. In view of the pitifully small group of men who have been engaged in the study of dental problems, and the meager funds available for their activity, the advancement in dentistry is very commendable indeed.

Under existing economic difficulties, it is doubtful whether any large project can be undertaken in dental research; but when the prevailing financial conditions improve, every effort should be made to organize our research activities into group endeavors, in which well-selected and suitably trained men would be gathered together in a scientific attack upon the problems which lie within the scope of our profession. It is only by such means that the problems in oral pathology and in dental practice will be solved, and the profession of dentistry may become a truly scientific branch of the healing arts.

III. Index of Names of Participants, and Sequence Numerals of Corresponding Abstracts

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IV. First Session: Morning; March 18; Abstracts 1–10

1. Methods of dental research before 1800

George B. Denton, Ph.D., Dental School, Northwestern University, Chicago, Ill.

Dental research, meager in quantity but creditable in character, existed before 1800. Gross anatomy of teeth, human and comparative, was completely covered. Odontogenetic problems, movements of mandible, and etiology of hypoplasia and of caries were studied scientifically. Dental histology, histo-pathology, and properties of dental materials were untouched. The method most commonly employed was dissection. One good clinical investigation was made by Bunon. Chemical analysis, staining *in vivo*, and simple measurement were used; rational experimentation was also employed. Measurement with precision instruments, microscopic observation, and statistical manipulation were unavailable. Research was conducted mostly by surgeons and anatomists; a little was done by dentists, that of Schaeffer (1757) on worms in teeth, and of Tenon (1767) on the eruption of horse teeth, are good examples.

2. Effects of saliva on gastric digestion

Leonard S. Fosdick, Ph.D., and Earl A. Zaus, M.D., Dental School, Northwestern University, Chicago, Ill.

Basal flow of saliva averaged about 0.5 cc. per minute. Stimulated flow, induced by gum chewing, averaged 2.5 cc. per minute, ranging between 0.9 cc. and 7.0 cc. per minute. Acid-neutralizing power of basal saliva showed both individual and group variations; the average was equivalent to 0.017 *N* NaOH. Stimulated saliva usually ran higher than basal, and was equivalent to about 0.025 *N* NaOH. Test meals of 100 cc. of saliva produced little or no stimulating effect upon gastric secretion. Salivary mucin did not directly influence the action of pepsin. Saliva affects peptic activity indirectly, by changing the pH of gastric contents, swallowed saliva causing both dilution and neutralization. The degree of change depends upon rate of secretion of saliva that is swallowed and height of the gastric-secretion curve. The greatest effect upon free HCl in gastric juice occurs during the early period of digestion, when salivary flow is abundant owing to

stimulation by mastication of food. This accounts in part for the slow rise in free HCl early in the digestive cycle, although the acid-secreting glands are very active. (To be published in *Journal of Dental Research.*)

3. SOME STUDIES ON CHEMICAL COMPOSITION OF HUMAN SALIVA

Edward C. Wach, Ph.G., D.D.S., College of Dentistry, University of Illinois, Chicago, Ill.

The paper presents a summary of data for K and Ca contents of human mixed saliva, and correlation with the K-Ca content of blood serum. Results for 30 patients were tabulated: 14 active and susceptible; 10 immune to caries; 5 with gingival erosion; 1 with ulcerous gingivitis. The K-Ca ratio of saliva was approximately 10:1, but considerable variation was observed. The K content of saliva is lowest in cases of active caries; 13 mgm. per 100 cc. lower than in immune cases, and 16 mgm. per 100 cc. lower than in cases of gingival erosion. No apparent ratio-relationship exists between the K-Ca of blood serum and of saliva and immunity to caries. Very little K in saliva is combined as mucin. (To be published in *Journal of Dental Research.*)

4. EFFECTS OF SALIVA ON GROWTH OF BACTERIUM COLI

O. W. Clough, B.S., D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

The author reports preliminary observations of effects, on *B. coli* and other microörganisms, of saliva added to culture media. Tubes were arranged to contain equal volumes of Douglas broth, and saliva filtered through Berkefeld V-candles. In control tubes, autoclaved tap-water replaced salivary filtrate. Equal inocula of bacterial cells were introduced into both test and control tubes, and number of organisms in each tube estimated at intervals by means of direct counts in a hemocytometer. Further control observations were made with salivary filtrate heated to 68°C. for an hour. In sixteen experiments with *B. coli* fewer cells developed in tubes of salivary-filtrate medium than in tap-water controls. In six tests in which comparison was made between heated and unheated salivary filtrates, more organisms were

found in heated than in unheated media. A few tests with staphylococci pointed to similar inhibitory action by saliva, but no such effect was noted when pneumococci were employed. These observations indicated that filtered saliva may exert inhibitory effects on the growth of *B. coli* and possibly on staphylococci. This influence was not exerted by heated salivary filtrate.

5. DAILY FLUCTUATION IN NUMBER OF MOUTH BACTERIA REMOVABLE BY RINSING

Martin T. Siegel, Martin E. Lerner, and J. L. T. Appleton, Jr., B.S., D.D.S., School of Dentistry, University of Pennsylvania, Philadelphia, Pa.

The number of bacteria in mouth rinsings, determined by the Breed method, were noted as follows, indicated in percent: On rising: 8.15 a.m.—100. Teeth cleaned: 8.30—43. Breakfast: 9.00—49; 11.00—64. Lunch: 11.30—46; 4.30 p.m.—78. Dinner: 5.00—53.

6. INFLUENCE OF ROENTGEN RADIATION ON ANTIBACTERIAL ACTION OF CERTAIN CHEMICAL SOLUTIONS

L. I. Grossman, D.D.S., Dr.Med. Dent., and J. L. T. Appleton, Jr., B.S., D.D.S., School of Dentistry, University of Pennsylvania, Philadelphia, Pa.

Tests were made *in vitro*. Oral bacteria suspended in serum agar were exposed to clinically tolerated dosage of roentgen rays, or chemical solution, or both. For comparative purposes electrolysis of zinc iodid-iodin solution was also carried out. It was found that (1) roentgen radiation of an inoculated area had no antibacterial effect. (2) Antibacterial effects of a chemical solution were not appreciably greater when inoculated area and chemical solution were simultaneously irradiated. (3) Roentgen radiation of solutions of rare-earth chemicals did not in general enhance antibacterial effects of such solutions. Only lanthanum ammonium chlorid and uranium iodid showed slightly increased antibacterial effects after irradiation. (4) Greater antibacterial effect was uniformly obtained from an electrolysed chemical solution than from the same solution without electrolysis. (5) Antibacterial effects from electrolysis of zinc iodid-iodin solution were always greater than effects of irradiation of any chemical solutions

in any series, with the exception of neodymium ammonium chlorid and thorium nitrate. (6) These observations do not encourage a belief that the antibacterial effect of root-canal medicament would be enhanced by irradiation of the periapical tissues.

7. COMPARATIVE VALUE OF METAPHEN AND IODIN SOLUTIONS IN PREOPERATIVE STERILIZATION OF ORAL MUCOSA, ESPECIALLY PREPARATORY TO INJECTION OF LOCAL ANESTHETICS

H. M. Rode, H. J. Ginns, and J. L. T. Appleton, Jr., B.S., D.D.S., School of Dentistry, University of Pennsylvania, Philadelphia, Pa.

Tests were made on man under clinical conditions, with the following results, expressed as percent (of thirty tests) showing no growth on blood-agar slants after 72-hour aerobic incubation: Tinct. metaphen, 0.5 percent—31. Talbot's iodin—93. Tinct. iodin, 1.0, acetone, 1.5, glycerine, 0.5—80. Iodin, ether, glycerine—93.

8. PREPARATION OF A NEW SERIES OF LOCAL ANESTHETICS

Harold L. Hansen, Ph.D., and Leonard S. Fosdick, Ph.D., Dental School, Northwestern University, Chicago, Ill.

In recent years numerous synthetic studies have resulted in producing many local anesthetics, none of which seems to conform much more closely than novocaine to the ideal local anesthetic. Further study will probably produce more efficient anesthetics, and also throw more light on the relationship between chemical constitution and physiological activity. Growing importance of sulfur compounds in chemistry suggested the desirability of preparing thio-esters of novocaine type. It was anticipated that these compounds would be less toxic than corresponding oxygen esters, and that the content of sulfur would not greatly alter physiological properties. Pharmacological studies seem to bear out these assumptions (see succeeding abstract).

9. STUDIES ON A NEW TYPE OF LOCAL ANESTHETIC

Leonard S. Fosdick, Ph.D., and Harold L. Hansen, Ph.D., Dental School, Northwestern University, Chicago, Ill.

Pharmacological studies on thio-esters of novocaine type were made, on white *mice*, with compounds prepared in this laboratory (see

preceding abstract). Thiocaine appeared to be one-half as toxic as cocaine, and about two-and-one-half times as toxic as procaine. As an anesthetic, thiocaine, by the gold-fish, wheal, and rabbit-cornea methods, was about four times as efficient as procaine. As a topical anesthetic, thiocaine, by the rabbit-cornea method, was about twice as efficient as cocaine. Tested on frog foot, frog mesentery, and rabbit ear, thiocaine was neither vaso-constrictive nor vaso-dilative. Thiocaine solution, injected intravenously into a *dog*, was without effect on blood pressure but stimulated respiration; death was caused by respiratory paralysis. Two infiltrations and one zygomatic injection with 0.5 percent thiocaine without epinephrine, in *human* patients for extraction of teeth, gave satisfactory results, indicating that in therapeutic doses thiocaine is more effective and less toxic than procaine.

10. HOWE'S SOLUTION—"AMMONIACAL SILVER NITRATE"

S. M. Gordon, M.S., Ph.D., and E. W. Shand, M.S., Ph.D., Bureau of Chemistry, American Dental Association, Chicago, Ill.

Howe's solution, prepared from silver nitrate and ammonium hydroxide according to the original directions (*Dental Cosmos, 58:* 891; 1917; Sept.), was found to be one of silver ammoniacal nitrate [$Ag(NH_3)_2NO_3$] and not of silver ammoniacal hydroxide [$Ag(NH_3)_2OH$] as claimed by some. The chemistry of the process is discussed, and standards for the evaluation of Howe's solution were indicated. (Published in *Journal of the American Dental Association, 20:* 530; 1933; March.)

V. SECOND SESSION: AFTERNOON; MARCH 18; ABSTRACTS 11–20

11. INFLAMMATORY ZONES IN DENTINE

Theodore B. Beust, D.D.S., M.D., F.A.C.D., School of Dentistry, University of Louisville, Louisville, Ky.

The paper deals with hyper-active, hyper-chromophilic zones adjoining the visible tracts in dentine resulting from caries, abrasion, erosion, or any other irritation. These were discussed at the meeting of the American Dental Association, in Buffalo in 1932. Interpretations of the findings assume that the dentine in these zones has under-

gone changes comparable with reactions created by irritation in any other tissue. These observations constitute an important contribution to knowledge of the factors of defense in teeth. (To be published in *Journal of Dental Research.*)

12. DOES USE OF PASTEURIZED MILK CAUSE VARIATION FROM NORMAL IN THE CRYSTAL STRUCTURE OF ENAMEL FORMED DURING THE PERIOD OF USE OF SUCH MILK?

Paul C. Kitchin, M.S., D.D.S., and Robert D. McFarland, D.D.S., College of Dentistry, Ohio State University, Columbus, Ohio

Of three groups of white rats, one was given dog biscuit, cod-liver oil, carrot, and water; the second, raw milk, carrot and water; the third, pasteurized milk (from same source as raw milk of second lot), carrot, and water. The period of special feeding covered 113 days, during which the animals were weighed periodically, and examinations of blood made three times. It was found that (1) pasteurization of milk reduced its nutrient value. (2) Rats fed milk, raw or pasteurized, were anemic, and lacked the usual orange coloration of incisor enamel. There were no observed (3) optical variations from normal in the crystal structure of incisor enamel in any group. (To be published in *Journal of Dental Research.*)

13. STUDIES OF X-RAY OPACITY OF ENAMEL AND DENTIN

G. Van Huysen, D.D.S., S. L. Warren, A.B., M.A., M.D., F. W. Bishop, and H. C. Hodge, B.S., M.S., Ph.D., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

The authors describe a roentgen absorption-method to study changes in dentin by comparing the opacity, to roentgen rays, of a precision roentgen-ray penetrometer with the opacity of areas in thin plano-parallel sections of dentin. The roentgen-ray opacities are measured by a precision densitometer permitting quantitative estimation of changes in dentin. It was found that (1) dentin and aluminum have almost exactly equivalent total roentgen-ray absorptions. (2) Different areas of dentin in the same tooth may have different roentgen-ray absorptions. (3) Normal dentin specimens from different teeth have approximately equal absorptions. (4) Certain areas of dentin under-

neath carious infection give increases in roentgen-ray absorption of 10–25 percent compared with normal dentin.

14. MACROSCOPIC AND MICROSCOPIC CHANGES IN TEETH OF RATS ON DIETS CONTAINING FLUORINE

Henry Klein, D.D.S., Sc.D., and E. V. McCollum, Ph.D., Sc.D., School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Md.

To the naked eye, the enamel of incisors in rats, on diets containing fluorine, appears rough and pitted, this defect occurring on labial aspects of upper and lower incisors. The pitting is seen, on removed incisors, to extend all along the developing portions, including the dentine on lingual or inner surface of these parts; molars do not exhibit this change. Decalcified sections show definite hypoplasia of incisor enamel and dentine; there were no apparent changes in molars. Ground sections of incisors reveal extreme hypoplasia of the enamel, simulating hypoplasias experimentally produced in pigs, as previously reported by the authors; molars do not show this change. The findings seem to indicate that changes in teeth of rats that result from ingestion of fluorine are largely produced during developmental stages of tooth formation.

15. SPECTROGRAPHIC ANALYSIS OF TEETH OF RATS ON DIETS CONTAINING FLUORINE

Harold Blumberg, Henry Klein, D.D.S., Sc.D., and E. V. McCollum, Ph.D., Sc.D., School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Md.

Spectrographic study has shown that incisors of rats on a *control* diet contain traces of F. Both upper and lower incisors of rats on food containing 0.05 percent of NaF show greatly increased concentration of F thus demonstrating added deposition following increased ingestion of F. There is also similar rise of F in skull bones as compared with traces in control bone. This increase of F was approximately equal in enamel and dentine of both upper and lower incisors. The increased F content in defective enamel supports the view that production of defective enamel, on diets containing F, is due to develop-

mental, structural, F-inclusion during dental growth, rather than to external etching after tooth eruption.

16. EFFECTS OF OATMEAL INGESTION, AT HIGH LEVELS, ON SUSCEPTIBILITY OF RATS TO DEFECTIVE CALCIFICATION AND TOOTH DECAY

H. L. Whittle, M.D., Henry Klein, D.D.S., Sc.D., and E. V. McCollum, Ph.D., Sc.D., School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Md.

A diet having 77.5 to 79.5 percent of oatmeal, containing adequate levels of Ca and P, was fed to six groups of ten rats each, as follows: (1) Oatmeal diet, plus 5 percent butter fat. (2) Oatmeal diet, plus 3 percent cod-liver oil. (3) Oatmeal diet, plus viosterol (15 drops per kilo of ration). (4) Diet 1, plus tomato juice. (5) Diet 2, plus tomato juice. (6) Diet 3, plus tomato juice. All animals were examined for cusp fracture, cusp-calcification excellency, cusp caries, interproximal caries, sulcus caries, pulp hemorrhage. Neither macro- nor micro-dental caries was found in any rat. Cusp fractures occurred in all groups, but no cusp caries was noted. Excellency of calcification of cusps was fair in groups 1 and 4; fair to good in groups 2 and 5; excellent in groups 3 and 6. In no group was calcification less than that seen regularly on stock rations. There was no defective calcification; no interproximal caries; no indication of sulcus caries. Pulp hemorrhages were noted in all groups, least in degree in group 6. Second-generation rats (on same diet) did not show this hemorrhage phenomenon so consistently or markedly as first-generation animals. Reasons for the marked hemorrhages are under investigation. Data on second-generation animals are like those for the first generation in incidence of cusp fractures, absence of macro- and micro-caries, and degree of cusp and root calcifications.

17. REACTION OF RAT TISSUE AND HUMAN TISSUE TO GUTTAPERCHA

E. P. Boulger, D.D.S., L.D.S., Chicago College of Dental Surgery, Dental Department of Loyola University, Chicago, Ill.

Tissue tolerance to guttapercha was studied histologically in three different ways: guttapercha implantations in rat tissue were sectioned; human teeth with pulp-canal fillings were extracted, apices implanted

in rats, and surrounding tissues sectioned; and teeth filled with gutta-percha were extracted and sectioned. In all instances, the gutta-percha was incapsulated, or in direct contact with connective tissue showing no inflammatory reaction, excepting cases in which infection had been present at implantation. In human teeth filled with gutta-percha, deposition of cementum occurred directly upon the gutta-percha. (To be published in *Journal of the American Dental Association.*)

18. STRESSES IN THE PARADONTIUM

A. B. Gabel, M.A., D.D.S., Dental School, University of Pennsylvania, Philadelphia, Pa.

No manuscript received for publication.

19. PERIODIC TRANSITORY MENO-GINGIVITIS INCIDENTAL IN WOMEN: A NEW NON-PATHOLOGICAL CLASSIFICATION OF GINGIVAL DISTURBANCE

Charles I. Stoloff, D.D.S., New York City

A syndrome of discomfort, sensitiveness, redness and congestion, and ready bleeding under normal stresses of mastication and tooth brushing, is described as occurring in the mouths of women. The syndrome, characteristic of *periodical transitory meno-gingivitis*, is thus designated by the author because of periodic appearance, transitory nature, and occurrence at monthly intervals. From observations over a period of twelve years, he finds the syndrome a common occurrence in the mouths of most women. It is apt to be overlooked because many women feel premonitory physical indications of the menses, such as hypersensitiveness, nervousness, weakness, etc. It appears periodically in acute form when mouth hygiene is neglected, or when local and systemic irritants are present, particularly in women subject to or suffering from acute functional gynecological disturbances other than pregnancy. The syndrome has often been observed in acute form, in various cases, just prior to initiation of menstruation; in amenorrheas of different types; in cases of post-hysterectomy prior to and after unruptured ectopic; and during and after the menopause. Diagnosis of this condition is never justified by one observation; it should be checked-up over a period of several months. Periodic transitory

meno-gingivitis should be suspected in cases of gingival disturbance that appear to clear up under approved methods of gum treatment, but which periodically relapse without apparent local justifiable cause. Knowledge of the dates of menstruation should be available for differential diagnosis. Coöperation of the patient's physician is necessary to determine whether she suffers coincidentally from functional gynecological disturbance.

20. BLOOD-PHOSPHORUS INSUFFICIENCY IN PYORRHEA

Carl J. Grove, D.D.S., Ph.G., and Carl T. Grove, D.D.S., St. Paul, Minn.

In certain types of pyorrhea the characteristics of the bone degeneration indicate the disease may be systemic in etiology. Blood serum in pyorrhea is definitely low in P, ranging from 2.2 to 3.4 mg. per 100 cc., with concomitant rise in content of Ca. Normal-serum P has been variously placed at 3 to 4.5 mg. per 100 cc. of blood; Ca, at 9 to 10 mg. per 100 cc. However, in establishing this normal, presence or absence of pyorrhea was not taken into consideration. The average blood-P in pyorrhea, in our cases, was 2.70 mg. per 100 cc., which is definitely low. The average Ca was 10.99 per 100 cc., which is definitely high. Our P determinations were made immediately after drawing blood, because blood upon standing liberates esters, which concentrate the P, producing much higher readings than normally. After standing twenty-four hours, P readings have increased to three times original findings. P estimates were made by Benedict's colorimetric method; Ca, by Clark's method. In development of bone, P is just as essential as Ca. Therefore it is quite probable that insufficiency of P in blood has an important influence on bone degeneration like that in pyorrhea. If this assumption is correct, it is obvious that a balance of mineral salts must be reëstablished to arrest further bone degeneration. Since content of P is consistently low in the blood in pyorrhea, this mineral unbalance is sufficiently important to require attention in treatment of periodontal disease. It is safe to assume that disturbed inorganic metabolism is due either to abnormal excretion or impaired absorption. Alkalinity in the alimentary tract causes production of insoluble and unabsorbable products of Ca and P. Alimentary acidity is a factor in supplying Ca and P to the body, because it keeps their products

soluble. Since absorption of mineral salts occurs in the small intestines, it is important that the intestinal contents should be sufficiently acid to maintain Ca and P in soluble states. We correct this derangement by medication rather than by diet, with gratifying results.

VI. Third Session: Evening; March 18; Abstracts 21–30

21. Studies on solubility of enamel

J. C. Forbes, M.A., Ph.D., Medical College of Virginia, Richmond, Va.

Carbon dioxide, in concentrations comparable to that of alveolar air, has definite solvent action on enamel. Solubility is reduced by calcium and phosphates in the solution; and also by increase in initial pH values of the solutions. Rate of decalcification in artificial saliva containing glucose, and inoculated with normal saliva, was greatly affected by initial pH values of the solutions, very rapid decalcification taking place at low pH values, *e.g.*, pH 5.7; slow decalcification, at high pH values, *e.g.*, pH 7.3. This change in speed of decalcification is explained by decrease in acid-neutralizing action of the solution, with decrease in pH; also by possible retardation in growth of aciduric organisms at higher pH values. (To be published in *Journal of Dental Research.*)

22. The microhardness of transparent dentine

Harold C. Hodge, B.S., M.S., Ph.D., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

The author describes a method whereby the location of any given microscope field on a tooth may be precisely determined. Using the microcharacter, microhardness of dentine in about thirty teeth was measured. On the basis of appearance, dentine is classified as normal, transparent, and sclerotic. Transparent dentine is further classified according to location as (1) transparent crown-dentine ("transparent secondary-dentine," in the center above the pulp cavity); (2) transpafent root-dentine; (3) semi-transparent peripheral-dentine (along the dentino-enamel junction); and (4) transparent reaction-dentine (between carious infected dentine and uninfected dentine). In each of ten teeth transparent crown-dentine was harder than normal dentine—average, 12.8 percent; in five teeth, softer by 8.0 percent;

in four teeth, the degrees of hardness were equal. In all, transparent root-dentine was as hard as normal root-dentine. In all but two, semi-transparent peripheral-dentine was harder than normal crown-dentine by an average of 10.4 percent. In the two excepted, the tissues were equally hard. Generally, transparent reaction-dentine is harder than infected dentine, but like normal dentine in hardness. (To be published in *Journal of Dental Research.*)

23. ERUPTION OF HUMAN TEETH

Rudolf Kronfeld, D.D.S., M.D., Chicago College of Dental Surgery, Dental Department of Loyola University, Chicago, Ill.

Eruption of human teeth is a complex process, resulting from growth of the root, changes in configuration of the alveolus, and active movement of the erupting tooth. By comparing and superimposing labio-lingual sections through human lower central deciduous and permanent incisors of different ages, from birth to fifteen years, the rôle of various factors involved in tooth eruption may be determined.

24. UNUSUAL TUMOR OF UPPER JAW

W. H. G. Logan, D.D.S., M.D., LL.D., M.S., F.A.C.S., F.A.C.D., Chicago College of Dental Surgery, Dental Department of Loyola University, Chicago, Ill.

The author reports a case of fast-growing central tumor of the upper jaw, involving the body of the right maxilla, apparently originating in the floor of the maxillary sinus. Patient: female; age, 23. Roentgenographic examination revealed extensive destruction of buccal plate, and supporting bone and alveolar process of first bicuspid, first and second molars, and tuberosity. The growth extended nearly to the floor of the orbit, and passed down between the roots. Biopsy taken included the oral buccal mucosa and underlying growth as the bone was destroyed. *Report on microscopic sections—Specimen 1*: rather dense fibrous tissue, covered partly by squamous epithelium, with traces of striated muscle in deeper parts. *Specimen 2*: fibrous tissue, covered by epithelium; in deeper parts of fibrous tissue were bits of normal bone; this fibrous tissue passed abruptly into an area of mucoid or myxomatous tissue without any definite borders. *Microscopical diagnosis*: myxoma.

25. TUMORS OF HYPOPHYSIS RESEMBLING CERTAIN TUMORS OF JAWS

E. B. Fink, M.D., Ph.D., Chicago College of Dental Surgery, Dental Department of Loyola University, Chicago, Ill.

A common form of tumor of the hypophysis consists of cords of squamous epithelial cells having a tendency to undergo cystic and other forms of degeneration. Three cases of tumors of the hypophysis, containing numerous teeth in various stages of development, have been described. These tumors have many histologic characteristics in common with adamantinomas and odontomas of the jaw. This similarity in structure may be explained by the fact that the anterior lobe of the hypophysis develops from embryonal oral ectoderm.

26. EFFECT OF SINGLE DOSE OF ERGOSTEROL OR PARATHORMONE ON HISTOLOGIC STRUCTURE OF DENTIN OF RAT INCISOR, CORRELATED WITH BLOOD-CALCIUM FINDINGS

I. Schour, B.S., D.D.S., M.S., Ph.D., and A. W. Ham, M.B., College of Dentistry, University of Illinois, Chicago, Ill., and University of Toronto, Toronto, Can.

This study includes three series: (A) 25 adult rats received one dose of 0.5 cc. of ergosterol 10,000 X; 4 controls. (B) 6 rats weighing about 160 grams received one dose of 0.75 cc. of ergosterol 10,000 X; 2 controls. (C) 6 rats weighing about 110 grams received one dose of 40 units of parathormone (Lilly); 2 controls. The animals were killed at 12- to 24-hour intervals up to 116 hours after dosage. A blood calcium analysis was made of each at death. Incisors were studied in ground and decalcified sections. In series *A* and *B*, blood calcium rose to 17 mg. per 100 cc. of serum during the first seventy-two hours, and subsequently declined to normal. Dentin formed during the rise in serum calcium was poorly calcified; during the decline, was well or excessively calcified. Series *C* showed similar but less intense changes. If vitamin D acted by simply increasing absorption or ionization of calcium, or if parathormone acted by stimulating active liberation of calcium from bones, the calcification of dentin should not have been disturbed during rise in the serum-calcium level. (No osteoclasts were present in the dentin.) These findings, therefore, indicate that vitamin D acts through the parathyroid mechanism; that parathormone acts

by controlling a fraction of serum calcium. The sensitivity of dentin changes in calcium metabolism is comparable to that of the feather test for the female sex-hormone.

27. FURTHER DATA ON CHEMICAL FACTORS OF SALIVA RELATED TO IMMUNITY AND SUSCEPTIBILITY TO DENTAL CARIES

Weston A. Price, D.D.S., M.S., F.A.C.D., Dental Research Laboratories, Cleveland, Ohio

The author's further studies[4] have included 960 individual chemical analyses of salivas for persons living in 105 different places distributed through 14 countries. The new data support those previously reported. The treatment consisted of reinforcing nutrition, as previously outlined, with fat-soluble activators and foods having high content of minerals. Before treatment, addition of bone to saliva increased the inorganic P, 3.07 percent; after treatment, addition of bone decreased the reading 13.1 percent, a change of 16.17 percent. In no case has active caries progressed as determined by clinical and roentgenographic study. In practically all cases there was physical improvement with increase of energy.

28. SOME CHEMICAL FACTORS OF SALIVA APPARENTLY RELATED TO ALVEOLAR DECALCIFICATION AND PYORRHEA ALVEOLARIS

Weston A. Price, D.D.S., M.S., F.A.C.D., Dental Research Laboratories, Cleveland, Ohio

In a typical case of acute alveolar decalcification, or so-called pyorrhea alveolaris, age 25, alveolar bone of all four first permanent molars had been markedly absorbed, accompanied by typical pyorrhea pockets with some loosening. Before nutritional treatment, filtered saliva shaken with powdered bone *gained* 33.57 percent of Ca, and 2.18 percent of inorganic P. After nutritional treatment with fat-soluble activators and foods high in mineral content, salivary Ca *decreased* 68.13 percent, inorganic P 19.4 percent, both of which conditions the author has shown to be near to normal. Clinically there was very marked improvement. These data suggest relationship between fat-soluble

[4] Price: *Journal of Dental Research*, 1932, xii, p. 540; *Dental Cosmos*, 1932, lxxiv, p. 1139.

activators and calcium utilization, and the etiology of pyorrhea alveolaris.

29. ORAL CONDITIONS OF AGRANULOCYTOSIS PRECIPITATED BY EXTRACTION OF TEETH

T. J. Cook, D.D.S., Dental School, University of Pennsylvania, Philadelphia, Pa.

The author reports ten cases in which the condition is believed to have been precipitated by extraction of teeth. In some cases a local anesthetic was used; nitrous oxide, in others. From one to seven teeth were removed at a time. Practically all cases presented the same oral manifestations—in appearance and discomfort to the patient. Fusiform bacillus and Vincent's spirillum were not present in large numbers. The author hopes, through gradual increase in number of cases now being identified, to be able, with adequate statistics, to substantiate his clinical impressions. Since it is uncertain whether agranulocytosis is a disease entity or merely a hematologic manifestation of various unrelated diseases, "agranulocytosis" is used here with reservations.

30. CONDITIONS OF OCCLUSION OF TEETH IN CONGENITAL SYPHILIS

F. R. Stathers, D.D.S., School of Dentistry, University of Pennsylvania, Philadelphia, Pa.

In a study of occlusion of teeth and deformities of jaws of sixty-nine individuals under treatment for keratitis characteristic of congenital syphilis, it was found that the high arched palate, claimed by many as one of the commonest anomalies of heredo- or congenital syphilis, was the exception rather than the rule, appearing in only about 23 percent. The maxillary arch, as a rule, was normal in size and symmetrical, with slight narrowing in the canine region in all cases showing "dwarfing," "pegging," or "screw-driver" incisors. This narrowness was attributable to deficiency in the mesio-distal diameters of these teeth alone, although it might have been an associated condition. The mandibular arch seemed as a rule too large—a condition in which there appeared to be overdevelopment of the mandible itself, as indicated by lingual tipping of teeth, particularly in the molar region.

Measurements taken from bucco-gingival margins showed equal and, in many cases, greater width in the mandibular than in the maxillary arch, in about half the cases examined. "Open bite," or failure of maxillary incisors to attain normal overlapping of mandibular incisors, occurred in approximately 70 percent. In some, this seemed due to failure in growth of teeth, as in "Hutchinson teeth" and pegged incisors, where crowns attain only about two-thirds their normal length. In others, it seemed to be caused by deficiency in development of the premaxilla, especially in vertical direction, giving the incisors the peculiarly arched appearance. In others, it seemed due to disturbance in growth of mandible or maxilla. These were extreme cases and showed greatest disturbance in tooth morphology. There was remarkable absence of crowding or mal-alignment of teeth. Slight crowding of mandibular incisors occurred in three cases, but the dentures otherwise were normal. No distinguishable hypoplasias were present; occlusion was normal.

VII. Fourth Session: Morning; March 19; Abstracts 31–40

31. formation of cavities in molar teeth in rats

Basil G. Bibby, B.D.S., and H. J. Sedwick, D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

Fifty rats were given synthetic diet consisting of ground yellow-corn, wheat gluten, calcium carbonate, and sodium chloride, with addition of various amounts of cod-liver oil; also 91 were fed soft kitchen scraps. Of the former, 41 developed molar cavities irrespective of the ration of cod-liver oil, whereas of the latter group only 6 showed this condition. Of these lesions 96 percent occurred in the first and second lower molars. In almost every case there was complete loss of posterior fissure-walls of the cavities, while anterior fissure-walls remained wholly or partially intact. A critical study of the literature showed that these changes have occurred in practically all studies of "rat caries," but had not been reported. Similarly, the amazingly close correlation between presence of hard particles (particularly of yellow corn) in the diet, and formation of cavities in lower molars, does not seem to have been appreciated. It was suggested that the peculiar normal morphology of the first and second mandibular molars of the

albino rat render them particularly liable to fracture, and that failure to appreciate this fact has confused past investigators. (To be published in *Journal of Dental Research.*)

32. QUANTITATIVE METHOD FOR RECOGNIZING BACILLUS ACIDOPHILUS IN SALIVA

Faith P. Hadley, M.S., and R. W. Bunting, D.D.Sc., School of Dentistry, University of Michigan, Ann Arbor, Mich.

A method for enumeration of B. acidophilus in saliva is described. The culture medium was Kulp's tomato-agar, acidified to pH 5.0, on which non-acid-resisting organisms, such as streptococci, are inhibited. All colony phases of B. acidophilus, including smooth, rough, and intermediate, grow well and are easily recognized. Methods for collection, dilution, and culturing samples of saliva are presented. Colony counts of acidophilus organisms are made, and number per cc. of saliva estimated. With this method for quantitative work, and the usual glucose infusion-broth for qualitative determinations, comparison of the aciduric flora of fifteen caries-susceptible and fifteen caries-free children was made. The cases were studied for eighteen months, and from four to six tests made for each child. In the caries-susceptible group all broth cultures were positive for B. acidophilus; organisms per cc. of saliva were numerous in a majority. Of the cases in which the caries-free group gave positive broth cultures from saliva, a majority showed very low acidophilus counts. With this quantitative test it was clearly shown that there is a marked difference between number of B. acidophilus organisms in the mouths of caries-free individuals and of caries-susceptible cases.

33. STUDIES ON BACTERIAL PLAQUES: APPARATUS FOR TESTING POROSITY

H. E. Friesell, D.D.S., Sc.D., LL.D., F.A.C.D., and J. J. Enright, Ph.D., Dental School and Mellon Institute, University of Pittsburgh, Pittsburgh, Pa.

Some technical difficulties in testing porosity of dental plaques have been overcome with a diffusion cell constructed as follows: one open end of a straight glass tube (5/8″ diameter) is cemented to a silver disc the size of a half-dollar pierced in the center by a round hole having

an area of 1 sq. mm. The silver base also contains three small bolts at equal distances from each other near the periphery. The lower side of the disc is carefully planed to fit another silver piece with an upper smooth side, and having a round hole at the center like that in the first disc. This lower disc also has three holes drilled to fit plumb with the three bolts of the upper disc. The plaque, isolated from a freshly extracted tooth with a safety-razor blade, is placed on the center holes between the two discs, and clamped in position by adjusting the nuts on the three bolts mentioned above. Experience is necessary to determine how tight the clamping should be to prevent leaks. Methods of testing for leaks, and the permeability of plaques to different agents, are under investigation.

34. ABRASIVE POWER OF TOOTH PASTES

K. W. Ray, Ph.D., and H. C. Chaden, B. S., Dental School, Northwestern University, Chicago, Ill.

Tests of abrasive power of several popular tooth pastes were made on metal specimens held onto a rotating paraffin-covered disc covered with suspension of paste to be tested. Both scratch tests and loss-in-weight tests were made. The hardness of the metal specimens was comparable to that of enamel, dentine, and cementum, respectively. None of the pastes had much abrasive action on materials as hard as enamel, but several scratched and rapidly wore away materials as soft as dentine and cementum. Some pastes caused more than ten times as much abrasion as others. In general, pastes containing chalk or calcium carbonate had the greatest abrasive action on the soft materials, but showed practically no action on the hard materials; those containing calcium phosphate had some action on the hard as well as soft materials. (To be published in *Dental Cosmos*.)

35. CONSIDERATION OF DATA AND CONCLUSIONS THAT REVEAL REASONS FOR CONFUSION CONCERNING KNOWN FACTORS RESPONSIBLE FOR DENTAL DECAY IN RATS

Henry Klein, D.D.S., Sc.D., School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Md.

No manuscript received for publication.

36. CRITICAL STUDY OF INCIDENCE OF CARIES IN CHILDREN

M. A. Munblatt, D.D.S., Orthodontic Research Group, Children's Fund of Michigan, and Merrill-Palmer School, Detroit, Mich.

This research is an outgrowth of a project undertaken by Drs. S. J. Lewis and I. A. Lehman, in March, 1924, on children in this School, to study growth and development of teeth and dental arches; and in April, 1930, duplicated in other institutions under active sponsorship of the Children's Fund of Michigan in cooperation with this School. Although the group under the directorship of Dr. Lewis was primarily concerned with orthodontic research, opportunity for the present collateral study became apparent. Four groups of children were studied: (a) 121 in the Merrill-Palmer School; (b) 118 in the Protestant Orphanage; (c) 179 in the Methodist Children's Village; and (d) 37 in the Sigma Gamma Convalescent Home for Children. Data were tabulated according to ages; percentages for incidence of caries were calculated separately for deciduous and permanent teeth. Filled teeth, and teeth lost through caries, were accounted for. We found that diet is an important factor in determining susceptibility or immunity to dental caries. As far as condition of teeth is concerned, children under good institutional care fare better than children in private homes. Changes in degree of susceptibility or immunity to dental caries in children from the same institution, and under changing environmental conditions at different periods of childhood, seem to point to systemic factors as responsible therefor.

37. CAUSES OF VARIATION IN HARDNESS OF GOLD-COPPER CASTINGS

Harry H. Asher, D.D.S., and John A. Comstock, B.S., College of Dentistry, University of Illinois, Chicago, Ill.

Gold-copper alloys made under hydrogen atmosphere, and one commercial 22-K alloy, were cast in uniform molds according to Bureau of Standards specifications for casting, and studied both microscopically and by detailed hardness tests. Variations studied were those due (a) to cavity formation, such as blowholes and shrinkage pipes; (b) to differences in composition of gold-copper solid solutions, such as coring and segregation; and (c) to precipitation of definite

compounds. Regardless of type of sprueing, formation of blowholes and shrinkage pipes always occurred. The conclusions were that the sprue should always be placed on small surfaces, and upon parts that will not be subjected to strains or stresses. Forces exerted during mastication break through surface blowholes, and offer pitted surfaces to which food debris adheres. This area forms a nidus for bacterial growth that may subject the same tooth or adjacent teeth to carious processes, or may harbor tenacious Vincent bacteria. At various levels of castings, crystallites were of different composition, those at the end having been richer in gold than those near the sprue. The castings were homogenized, this segregation having been removed by heating near the melting point. Unless some other element is used to bring about precipitation hardening, this factor is negligible and cannot be made use of in gold-copper dental alloys.

38. METHOD OF RECORDING FUNCTIONAL MOVEMENTS OF FULL-DENTURE BASES IN THREE DIMENSIONS

Carl O. Boucher, D.D.S., College of Dentistry, Ohio State University, Columbus, Ohio

Denture bases, because of very complex forces and guides involved, do not move in straight lines when in function. Positional or static registrations fail to record lateral stresses of function even though taken in three dimensions. Therefore, a recording apparatus that cannot register and reproduce all actual paths of denture bases must be considered inadequate. The apparatus described in this paper records and reproduces all *paths* of denture bases when in function, i.e., when the teeth are in contact. The registrations are entirely relative as to the bases, showing only end results, or combined effects of all known and unknown forces involved in jaw movements and occlusion of dentures. Condyle paths whether curved or straight, Bennett movement, compression of tissue, and shifting of denture bases on the ridges owing to force applied against the inclined planes of the teeth, are disregarded as such, but effects of these and any other forces are registered by the apparatus and reproduced on the articulator. (To be published in *Journal of Dental Research.*)

39. EXPERIMENTAL STUDY OF BEHAVIOR OF MOLTEN METAL DURING CASTING

Raymond E. Myers, D.D.S., B.S., School of Dentistry, University of Louisville, Louisville, Ky.

The author attempted to determine effects of length and gauge of sprues on the speed at which molten metal enters a mold cavity. Molds were prepared in which pattern chambers were connected with crucibles by two sprues, one of which was arranged as usual; the other was connected with crucible above the area to be covered by molten metal. Since the castings were made on a direct-pressure machine, the second spur functioned as an air-hole. During operation of the machine, air pressure was not only applied to the molten metal in the crucible, but was simultaneously conveyed through the air-hole to counteract passage of molten metal into the pattern chamber. In numerous experiments with varying degrees of casting pressure, lead sprues and air-holes were varied in gauge and length. The results indicate that when the air-hole is relatively large in gauge, and short in proportion to size of lead sprue, air enters the air-hole and fills the pattern chamber before molten metal leaves the crucible. Hence, pressure exerted to force metal into the mold is counterbalanced by the same pressure through the pattern chamber and lead sprue to retain metal in the crucible. On the other hand, when the air-hole is sufficiently small in gauge and long enough in proportion to the size of the lead sprue, metal fills the pattern chamber before pressure conveyed through the air-hole can prevent it.

40. METAL MOLDS FOR STANDARDIZED PLASTER TEETH FOR DEMONSTRATION AND TEACHING PURPOSES

C. W. Strosnider, D.D.S., College of Dentistry, Ohio State University, Columbus, Ohio

Models of all thirty-two teeth, including both crown and root, were carved from blocks of plaster of Paris, the finished teeth being five and one-half times Black's average measurements. With these master-teeth plaster patterns were made. For all anterior teeth the patterns were in three parts; for bicuspids, in four parts; for molars, in five. Aluminum-alloy castings were then made to reproduce the plaster

patterns. With these metal molds exact duplicates of the laboriously carved master-models may be produced in any number. Recently, when master teeth for the right half of the arches were carved and metal molds made, these molds were improved to overcome a tendency to collapse when assembled, by making the molds thicker, and by changing the shape of the lug and corresponding cavity that hold the sections of each mold together in proper relationship. A method of making plaster teeth with various types of vulcanite restorations has been developed. Using the single vulcanite restoration in its proper place in the mold, an unlimited number of plaster teeth, with cavities corresponding to the restoration, may be produced. Plaster teeth produced in thirty-two molds, with and without vulcanite restorations, have been carefully assembled into large plaster-arches with modeling clay and gelatin molds. Each tooth can be readily removed from its socket, and each restoration can be removed from the tooth in which it rests, thus facilitating any desired combination. (To be published in *Journal of Dental Research.*)

VIII. Fifth Session: Afternoon, March 19: Abstracts 41–51

41. Absorption of roots of temporary teeth: item in evidence

Frederick B. Noyes, B.A., D.D.S., Sc.D., F.A.C.D., College of Dentistry, University of Illinois, Chicago, Ill.

Material was obtained by sectioning crowns of temporary teeth picked off from the gum. Small bits of tissue adhering to the dentin furnished beautiful studies of osteoclasts. Study of this material indicated that (1) in this position osteoclasts are developed from cells of embryonal connective tissue. (2) At first they are small and mononuclear, and become large and polynuclear. (3) They are found wherever dentin is being resorbed. (4) As they become larger their cytoplasmic structure assumes characteristic complicated structure. (5) They are frequently united by cytoplasmic bridges, and even form continuous sheets of nucleated cytoplasm extending often over five or six howships lacunae. (6) Ground sections indicate that dentin is decalcified in advance of its removal. (Published in *Angle Orthodontist*, 1933, iii, p. 83; April.)

42. STUDIES OF FUSIFORM BACTERIA

Holmes T. Knighton, D.D.S., and Basil G. Bibby, B.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

By using blood-agar plates and hydrogen anerobiosis, isolation of fusobacteria (fusiform bacilli) from the mouth was relatively simple. Addition of gentian violet to blood or potato-extract media (Slanetz) rendered them somewhat selective for fusobacteria. Potato-extract medium and low-pressure-CO_2 anerobiosis, on the other hand, did not offer any advantages. The organisms have been tentatively separated into three morphological groups, which can be further divided by carbohydrate fermentation and indol tests. Difficulty was encountered in agglutination tests because spontaneous agglutination occurred with some strains, and natural agglutinins for the short type were found in sera of most rabbits examined.

43. MORPHOLOGIC STUDIES OF FUSIFORM MICROORGANISMS

M. S. Aisenberg, D.D.S., Dental School, University of Maryland, Baltimore, Md.

By means of the stem, the life history is traced, with the following conclusions: (1) The stem is segmented. (2) Branched stems were not observed, hence Beust is presumably correct in placing this organism under the genus Leptothrix. (3) The nature of the life cycle indicates that fusiform organisms in Vincent infection have not as yet been cultivated. (4) We agree with Beust that "the student of the fusiform bacillus would probably do well to dismiss, for the present, the thought that the fusiform organisms are bacteria. Rather, a generation of spores should be imagined which were developed from a parent." (To be published in *Dental Cosmos*.)

44. DIATHERMY TREATMENT OF PERIAPICALLY INFECTED TEETH

Louis I. Grossman, D.D.S., Dr. Med. Dent., Dental School, University of Pennsylvania, Philadelphia, Pa.

On the basis of the experimental and clinical data in this paper, it may be inferred that (1) the degree of antibacterial effect from a dia-

thermy current of clinically tolerated dosage passed through suspension of oral bacteria in blood agar (a) is less than that obtained by electrolysis of the culture medium; (b) is less than that obtained from zinc iodide-iodine electrolyte; (c) is distinctly less than that obtained by electrolysis of zinc iodide-iodine electrolyte. (2) Based upon the criterion of cultures to determine the effectiveness of a method for eliminating apical infection, the diathermy method gave uniformly unsatisfactory results in seven clinical cases in which it was tried. At least three of these cases later yielded negative cultures when another method of therapy was used.

45. COMPARATIVE STUDY OF "ELECTRO-STERILIZATION" WITH (A) SODIUM CHLORIDE ELECTROLYTE AND (B) ZINC IODIDE-IODINE ELECTROLYTE

Louis I. Grossman, D.D.S., Dr. Med. Dent., Dental School, University of Pennsylvania, Philadelphia, Pa.

Grossman and Prinz reported (*Dental Cosmos*, April, 1932) that, in a clinical study, an average of 2.5 treatments by "electro-sterilization" with a sodium chloride (or chloramine T) electrolyte were required to produce conditions for negative cultures from a previously infected pulpless tooth. The present paper reports fifty-four cases in which infected pulpless teeth were treated by "electro-sterilization" with zinc iodide (1 *M*)—iodine (0.1 *M*) electrolyte. For this group, there were required, to produce conditions for negative cultures, one treatment in 11 cases, two treatments in 32 cases, three treatments in 10 cases, four treatments in 1 case. Four was the maximum number of treatments necessary for a negative culture. About 60 percent required two treatments; about 80 percent, one or two treatments. As for the group previously reported by Grossman and Prinz, medication with camphorated monochlorphenol was used initially as follows: one treatment in 33 cases; two treatments in 11 cases; three treatments in 4 cases; no treatment in 6 cases. To obtain negative cultures from a previously infected pulpless tooth, fewer treatments by "electro-sterilization" with zinc iodide-iodine electrolyte (average, 2 treatments) were required than with sodium chloride electrolyte (average, 2.5 treatments).

46. PROBABLE FREQUENCY OF FALSE NEGATIVE CULTURES FROM ROOT CANALS

L. I. Grossman, D.D.S., Dr. Med. Dent., Dental School, University of Pennsylvania, Philadelphia, Pa.

From cases of periapical infection under treatment, cultures were taken and medicated dressings put into the canals. From 26 cases in which cultures were negative, second cultures were taken immediately before filling the canals. In only 2 cases were the second cultures positive. From this it is concluded that the probable frequency of false negative cultures is less than 8 percent. (To be published in *Journal of Dental Research.*)

47. DISINFECTION OF PULP CANALS AND PERIAPICAL TISSUE WITH SURGICAL DIATHERMY

Edgar H. Kramp, B.S., D.D.S., College of Dentistry, University of Illinois, Chicago, Ill.

Diathermy is a form of electrotherapy that generates heat within tissues distant from the location of its applicators, and is capable of administering heat wherever desirable—to any area, superficial or deep. It was applied, in concentration capable of producing destruction of tissue, in upwards of twenty-five infected root-canals. Treatments were conducted under aseptic conditions, and controlled by cultures from tissues at the root apex, taken with paper points and incubated 48 hours or more in semi-solid ascitic agar-medium. The canals, after yielding a negative culture (for one week), were filled with gutta-percha cones and x-rayed. Follow-up x-ray pictures will be taken six months after each filling was placed. The average number of treatments, each consisting of from two to three applications, was three. A majority of cases had only one canal. Those having multiple canals did not respond as readily, requiring an average of one or two more treatments. In most canals it was possible to coagulate and remove necrotic debris, which otherwise might have remained intact owing to insufficient curettage. In cases of discharging sinus, the discharge was discontinued, and the sinus healed, usually after the second treatment. In all cases the sinus healed before the canal was filled. Where gas-producing organisms subjected the tooth to severe soreness, producing inflammation of the "p. d. m.," application of diathermy stopped

gas formation and permitted a sealing of eugenol. The amount of current in these instances was less than where no acute inflammation was present. Where cultures remained positive after application of diathermy, and where long-chain gram-positive streptococci were prominent before application, long-chain streptococci seem to have been broken up into many gram-positive diplococci.

48. TISSUE REACTION ABOUT ARTIFICIAL ROOTS IMPLANTED IN JAWS OF DOGS

Kaethe W. Dewey, M.D., and Robert Zugsmith, D.D.S., Dental School, University of Pittsburgh, Pittsburgh, Pa.

Results of artificial-root implantation have been reported almost exclusively with reference to clinical, technical and roentgenological aspects of the procedure. Very little has been written regarding tissue-reactions about artificial roots. It is conceded that highly glazed porcelain-roots are most suitable because almost entirely non-irritating. In the present experimental work with dogs there was very rapid downgrowth of gingival epithelium over the raw surface of the socket. Three weeks after extraction of incisors and their replacement with porcelain roots, the sockets presented epithelial covering over more than two-thirds of their length. However, the effectiveness of this gradually developed protective lining was considerably reduced or interfered with by unavoidable bacterial invasion of the lacerated tissue, and by associated reactive formation of granulation tissue, all three processes going on simultaneously. The infiltrations diminished toward the fundus; the bone was intact, and extensive new bone formation was in evidence. In one dog four roots of various materials implanted in a row, substituting four lower incisors, were left in place for six weeks. Histologically, epithelization was demonstrable almost down to the fundus. But in this case, also, the epithelium did not form a complete lining, having been influenced by associated impacted material. There was a zone of very vascular granulation tissue, surrounded by a thick layer of dense connective tissue that acted as an encapsulating membrane, preventing or restricting extension of infection and infiltration. The underlying bone was not invaded, and showed both resorptive and regenerative processes.

Bone seems to be endowed with unusual powers of resistance to infections, as observations in experimental surgical work, in particular about the mandible, and study of tissues under artificial dentures, have shown. The author's further studies of the condition of the bone, of the changes the granulation tissue undergoes, and of the behavior of the epithelium, 2.5 and 4 months after implantation of artificial roots in dogs, justify definite conclusions as to the advisability or justification of recommending or rejecting the practice of root implantation. (To be published in *Journal of Dental Research.*)

49. MANIFESTATIONS OF LEUKEMIA IN THE ORAL CAVITY

Wilbur McL. Davis, D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

In six of seven cases of leukemia that came to autopsy, there were gross oral involvements ranging in degree from only a few scattered petechial hemorrhages to marked ulcerative stomatitis. Material removed from the gums and other parts of the oral cavity showed constant infiltration by leukemic cells, the amount of which did not vary in different types of leukemia. It was noted, however, that microscopical findings of infiltration might be present without marked gross signs. These findings indicate that extractions, or surgical work, should never be done for patients having leukemia, as there is marked retardation of healing, and sockets remain open and dry or fill slowly with spongy granulation tissue that often becomes necrotic and sloughs. Vincent infection is nearly always found in active form in terminal stages of leukemia. Therefore, the dentist should make an early correct diagnosis of the disease to avoid unnecessary or useless oral treatment.

50. EXPERIMENTS ON PRODUCTION OF LEUCOPLAKIA IN RATS

Wilbur McL. Davis, D.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

Smoke from cigars and unaged leaf tobacco, in a steady stream at approximately 38°C. and not exceeding 42°C., was applied to the tongues of twenty-eight rats under anesthesia. This was continued for from one to two hours, every other day, as long as the animal survived the repeated anesthesia, the total time of exposure for individual

rats ranging from two to fifty hours. Sections from all tongues exposed over six hours showed some degree of hyperplasia of the epithelium, but no leucoplakia was seen in any. Other workers have shown that epithelium of the albino rat is very resistant to products of combustion. This may account in some measure for failure of the tissues in the present study to show changes other than hyperplasia.

51. EFFECTS OF ORAL TREATMENT ON THE BLOOD PICTURE IN A CASE OF APLASTIC ANEMIA

L. S. Pettit, D.D.S., College of Dentistry, Ohio State University, Columbus, Ohio

The study aimed to ascertain possible relationships between oral infection and the blood picture, with special emphasis on the granular cells. The patient, white, 23 years old, had been confined to a hospital for chronic hypoplastic anemia. The treatment was intended (a) to prevent continual loss of blood from the gingivae, and (b) to eliminate, from the gingival crevices, sepsis that might act as a focus of infection and thus contribute to depression of all cellular elements from the bone marrow. An anti-Vincent mouth-wash was used, thorough curetting of teeth and gingival crevices performed, and arsphenamine in glucose solution applied to each crevice. The blood picture showed decided improvement following oral treatment. Total polymorphonuclear cells *increased* from 100 to 1800; total red blood-cells, from 1,000,000 to 2,800,000; blood platelets, from about 40,000 to 190,000; hemoglobin, practically 100 percent. Bacteriological tests showed very few Vincent organisms—not sufficient to induce clinical symptoms. The mouth condition responded very satisfactorily to treatment, returning almost to normal. (To be published in *Journal of Dental Research.*)

IX. Sixth Session: Evening; March 19; Abstracts 52–56

(Including annual dinner and annual business meeting)

52. THE AMERICAN DENTAL ASSOCIATION AND DENTAL RESEARCH

G. Walter Dittmar, D.D.S., F.A.C.D., College of Dentistry, University of Illinois; President of the American Dental Association

The American Dental Association has long been actively interested in support and promotion of dental research, and welcomes all endeavors

by other organizations to further advancement of dental science, and of dental art. In 1913 the American Dental Association created a "Scientific Foundation and Research Commission" the name of which, in 1927, was abbreviated to *Research Commission*. Under the auspices of the Commission, from its creation to April 1, 1933, $347,242.58 has been appropriated from the Association's funds, in special grants and otherwise, for the support of dental research in many relationships. This support includes coöperative research at the U. S. Bureau of Standards, with results that are expected to improve and standardize materials and processes in restorative practice. The Association, with the coöperation of the U. S. Public Health Service, has lately begun a thorough study of existing public conditions and facilities in oral health service, about which Dr. Messner will present details (abstract 55, below). It is a pleasure to note the increasing interest in dental research in universities, in schools of dentistry and medicine, and in the U. S. Public Health Service, as indicated by the steady growth of this Research Association, which I hope will continue to serve, with cumulative effectiveness, the cause of truth and idealism in dentistry.

53. INTERDEPENDENCE OF DENTAL RESEARCH AND DENTAL EDUCATION

J. Ben Robinson, D.D.S., F.A.C.D., School of Dentistry, University of Maryland, Baltimore, Md.; President of the American Association of Dental Schools

Dental research is careful and critical inquiry into unsolved dental conditions affecting oral health. It delves into unknown problems, and, to advance dental science, strives to push aside the curtain before hidden truths. Dental education is development of resources of intellect and skill of the candidate through careful instruction in biological and ancillary sciences upon which a rational art of practice may be superimposed. Discoveries contributed to dental science by research are an index of scientific progress of the profession. The chief values of dental research are not in discovery, but in the ultimate purpose to which its findings are applied for protection and maintenance of oral health. Research is applied most forcefully when its results are woven into the structure of educative processes. It is either an essential element of educational enterprise, or else a complement that must be closely linked thereto. Dental education cannot grow when

it is separated from and ignores investigation of dental problems, and cannot succeed when it fails to utilize contributions made by discovery. *Dental education and dental research are interdependent.* The former will survive and progress only by the vitalizing stimulus provided by products of research, while the purpose of the latter cannot be attained satisfactorily unless applied through channels of education. Investigation that merely embellishes the record of the researcher, and which does not apply its discoveries to use through some medium for final distribution to its ultimate purpose, is of no practical value. Education is contact between the fountain head of research and the general practitioner whose function is to distribute improved benefits to society. Research seeks to know, that it may serve; education is qualified to serve, because it knows. Research and education cannot be separated.

54. REVIEW OF THE STATEMENT ON DENTISTRY AND DENTAL EDUCATION BY THE COMMISSION ON MEDICAL EDUCATION

L. E. Blauch, Ph.D., Chicago, Ill.; Executive Secretary, Committee on Survey of the Dental Curriculum, American Association of Dental Schools

The Commission on Medical Education has recently published its *Final Report*, in which it expresses certain views regarding dentistry and dental education, and suggests that "dentistry should be developed under medical education."[5] The report gives no indication that this suggestion was based upon any objective investigation, or that the dental profession was consulted regarding the suggestion. Obviously a conclusion such as that suggested by the Commission should be based upon answers to several important questions. Some of these questions follow: (1) Just what is required in dental health service? Decisions regarding dental education should rest upon detailed information regarding dental health needs and dental service. (2) Is there reason to believe that autonomous dental education is unable or unwilling to cope with the problems of preparing men and women to render dental health service? (3) Would dental education under the auspices of medical education move forward more rapidly than if it

[5] Final Report of the Commission on Medical Education, 1932, Dec.; pp. 216–17.

remains autonomous? (4) What would be the psychological effect on the dental profession, if the training of dental practitioners were taken over by the medical profession? These are some of the questions that should be thoroughly studied by anyone or any group that desires to contribute to an understanding of the relationship between dental and medical education. The Commission on Medical Education has obviously not based its suggestions upon a thorough investigation of these and similar questions.

55. COMMITTEE FOR DENTAL HEALTH SURVEY

C. T. Messner, D.D.S., F.A.C.D., U.S. Public Health Service, Washington, D. C.; Chairman of the Committee

At the last annual meeting of the American Dental Association in Buffalo, September, 1932, a resolution was passed by the House of Delegates directing the President of the American Dental Association to appoint a committee to make a survey of existing dental-health facilities in state, municipal, and county health- and educational-organizations, and to create a program for recommendation to the American Dental Association for the more uniform and adequate recognition of dentistry in health organizations. Realizing that the American Dental Association had no funds to meet the expenses of this Committee, Dr. G. Walter Dittmar, President of the American Dental Association, took up the matter with Surgeon General Hugh S. Cumming of the U. S. Public Health Service and requested the assistance of the U. S. Public Health Service in making this fact-finding survey. After considerable correspondence as well as a personal visit by Dr. Dittmar to Washington, the Surgeon General agreed to furnish the necessary personnel for this survey. Dr. Dittmar then appointed his committee for the American Dental Association, consisting of twenty-nine members, nine of whom have been appointed the *Executive Council*. All these appointments were accepted for prompt initiation of the work.[6]

As this study could not be successfully conducted without full cooperation and support of the state health departments, the Surgeon General called a conference of the State and Provincial Health Authori-

[6] A short delay in the publication of the proceedings has made it possible to conclude this abstract with a brief statement of progress since the date of the meeting of the Research Association.

ties, with the Committee of the American Dental Association and the U. S. Public Health Service, to discuss plans and methods for the survey, and to obtain, if possible, the close coöperation of both associations. This meeting, held in Washington, D. C., April 28, 1933, was attended by the Executive Council of the Committee for Dental Health Survey, and five state health commissioners appointed by the President of the State and Provincial Health Authorities. The Surgeon General presided. After a full day of discussion, the Committee of State Health Officers made the following recommendation: "That the Committee of State and Provincial Health Authorities approve the dental-health survey as proposed to the Public Health Service, and that it coöperate with the American Dental Association and the U. S. Public Health Service to the fullest extent in carrying out this study." Although it may take at least two years to complete the work, it is hoped that a progress report of considerable extent can be made at the next annual meeting of the American Dental Association in Chicago, in August, 1933.

56. PRESIDENT'S ADDRESS: CERTAIN TRENDS IN DENTAL RESEARCH

R. W. Bunting, D.D.S., D.D.Sc., F.A.C.D., Dental School, University of Michigan, Ann Arbor, Mich.

Published in full on pages 175–181.

X. Papers Read by Title: Abstracts 57–115

A. Contributions by the Vienna Section: Abstracts 57–71

57. MORPHOLOGY OF THE ELEPHANT MOLAR

Fritz Driak, M.D., Dental Institute (Director Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria

Elephant molars were examined in macroscopic and microscopic grindings, histological sections, and roentgenographic pictures. An elephant molar consists of numerous (25 or less) lamellae having a dentin nucleus (with cavities for the pulp) and an enamel-covering, and being inter-connected by cementum. The literature indicates that the lamellae are individual formations connected only by cementum. The author has found, however, that the enamel covering at the base of the tooth is continuous, progressing from one lamella to the

next. Therefore it is concluded that the lamellae of one molar are not individual teeth connected only by cementum, but are developed from a common enamel organ. The enamel prisms are scale-like. The dentin fibres sometimes pass the enamel-dentin junction and end in the enamel. The cementum contains many cement corpuscles having numerous fine processes.

58. ACTIVE AND PASSIVE CONTINUOUS ERUPTIONS OF TEETH

B. Gottlieb, M.D., and B. Orban, M.D., Histological Laboratory (Director Dr. B. Gottlieb), Dental Institute (Director Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria

"Active eruption" means actual movement of a tooth toward the occlusal line; "passive eruption" means its movement toward the apex. Both movements proceed continuously. Active eruption, with increasing age of the individual, gradually becomes slower; passive eruption does not. Active eruption influences passive eruption, but not vice versa. While a tooth moves rapidly toward the occlusal line (clinical eruption of teeth, teeth without antagonists), the bottom of the crevice also rapidly moves toward the apex. So long as teeth move toward the occlusal line without coming into contact with antagonists, their movement is accelerated. Active eruption proceeds in the front teeth, which are not in strong occlusion, but in the molar region is retarded by occlusal stress. This accounts for the different levels of these groups of teeth, and also explains how this difference becomes greater for Angle's Class II.

59. SUCCESS AND FAILURE IN ROOT AMPUTATIONS

Otto Hofer, M.D., Jaw Department (Director Prof. Dr. H. Pichler), First Surgical Clinic (Director Prof. Dr. A. Eiselsberg), University of Vienna, Vienna, Austria

In this Department, 100 cases of root amputation (made during 1921–32) were controlled clinically and by x-ray. The clinical conditions, in many cases, did not agree with roentgen indications. Full regeneration of periapical tissues was indicated by roentgenograms in 50 percent of the cases, eight weeks after root amputation. The granulomata were invariably diminished post-operationem, proving that the prob-

lem of infection is a quantitative one. These examinations also showed that, in apicotomy, the root must be diminished and sloped (inclined) as little as possible. Root canals should not be enlarged too generously.

60. ACTINOMYCOSIS SUCCESSFULLY TREATED WITH EXTRACT OF LYMPH GLANDS (SEC. PROF. TRAUNER)

Emerich Kotanyi, M.D., Jaw Department (Director Prof. Dr. H. Pichler), First Surgical Clinic (Director Prof. Dr. A. Eiselsberg), University of Vienna, Vienna, Austria

Six patients presenting characteristic clinical pictures of actinomycosis, for which bacteriological examination was also positive, were treated with extract of lymph glands according to Prof. Trauner. The treatment was begun by surgical removal of all slack actinomycotic granulations. Then a poultice of lymph-gland extract was applied and changed daily. There was prompt cleansing of the wound, *followed by complete cure.* After the skin wound had healed, hypodermic injections of lymph-gland extract were made. The treatment depends upon the observation that, in most cases of actinomycosis, the regional lymph glands are not affected.

61. A CASE OF EPIGNATHUS

H. Mathis, M.D., University of Vienna, Vienna, Austria

No manuscript received for publication.

62. ACTION OF PARAFORMALDEHYDE ON DENTAL PULP

B. Orban, M.D., Histological Laboratory (Director Dr. B. Gottlieb), Dental Institute (Director Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria

When paraformaldehyde was placed on the surface of exposed pulp, necrosis of pulp tissues and inflammation of periapical tissues ensued. When paraformaldehyde, mixed with zinc oxide in a concentration up to 10 percent, was placed in a cavity having no pulp exposure, the pulp tissues remained vital but showed some signs of degeneration, and much secondary dentin developed (*fig. 1*). When only cement or amalgam was placed in a cavity, the amount of ensuing secondary

dentin was much less (*fig. 2*). The tests were made in teeth of fourteen dogs. (See illustrations on page 221.)

63. SIGNS OF TRAUMATIC OCCLUSION IN AVERAGE HUMAN JAWS

B. Orban, M.D., and J. Weinmann, M.D., Histological Laboratory (Director Dr. B. Gottlieb), Dental Institute (Director Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria

The authors studied a large amount of material from human jaws, obtained at autopsy and serially sectioned. In almost every jaw where teeth had been extracted, but not replaced by bridges, there were signs of trauma similar to those found by Gottlieb and Orban in experiments on traumatic occlusion in dogs. Necrosis of periodontal membrane was produced in places where heavy pressure had been applied. Surrounding bone was resorbed. In most cases there was no change on the surface of cementum. Hemorrhages and thrombosis of blood vessels were noted. In later stages of trauma, and in the region thereof, cartilage was formed in a manner analogous to its production after bone fracture in pseudoarthrosis. There was no observed connection between gum disturbances and changes in the periodontal membrane.

64. STATISTICAL RESEARCH ON EFFICIENCY OF BLACK'S PRINCIPLES IN FILLING CLASS-II CAVITIES[7]

H. Pichler, M.D., Dental Institute, University of Vienna, Vienna, Austria

Records of 700 approximo-occlusal cavities (Black's Cl. II), filled, according to the teaching of G. V. Black by the present author in his private practice, with amalgam, gold foil, or gold inlays from fifteen to twenty-five years ago, were studied with reference to permanence of such filling operations, and also to determine causes of failures. In 86.7 percent of gold-foil fillings, 84.9 percent of cast-gold inlays, and 61.3 percent of amalgam fillings, no recurrence of decay was found after an average of 18.5 years. This shows that gold and gold inlays were much more permanent than amalgam; also that gold inlays, even with the less exact technic of casting used in former days, are

[7] Pichler: Dauererfolge von Füllungen nach Black's Grundsätzen; *Zeitschrift für Stomatologie*, 1930, xxviii, p. 1005; Nov.

almost as good as gold-foil fillings. Recurrence of decay, when found, occurred along the buccal margin in 49.1 percent; at the lingual, in 15.7 percent; at the buccal and lingual, in 10.2 percent. Recurrent decay was found more frequently in distal cavities (70.1 percent) than in mesial (29.9 percent). This seems to show that extension for prevention ought to have been carried out more thoroughly at the gingivo-buccal angle of the cavities.

65. HISTOLOGIC INVESTIGATIONS OF DAMAGE FROM FAULTY CONTACTS BETWEEN TEETH

Otto Priessecker, M.D., Histological Laboratory (Director B. Gottlieb), Dental Institute (Director Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria

No manuscript received for publication.

66. RÔLE OF EPITHELIUM IN ELIMINATING FOREIGN BODIES IN THE JAW

Franz Schönbauer, M.D., Histological Laboratory (Director Dr. B. Gottlieb), Dental Institute (Director Dr. H. Pichler), University of Vienna, Vienna, Austria

In a 55-year-old patient a sequestrum was removed after osteomyelitis of the upper jaw. Epithelium on the surface of the sequestrum had the characteristic appearance of that on teeth. On necrotic portions of the sequestrum, the bone corpuscles were lost, the epithelium having separated from the surface. Where bone corpuscles were present, however, epithelium was firmly attached to the surface. Similar findings were noted in jaws of rats and dogs. These observations corroborate the theory of Gottlieb on the connection between downward growth of epithelial attachment and vitality of cementum.

67. POSITION OF GERMS OF DECIDUOUS TEETH AT BIRTH

A. Martin Schwarz, M.D., Histological Laboratory (Director Dr. B. Gottlieb), Dental Institute (Director Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria

The position of the deciduous incisors in both jaws, at birth, varies about 50 grades between protrusion and retrusion. Early in embryonic development, the germs of deciduous teeth lie in a row without lack of

space, those of lateral incisors being disposed somewhat orally from the first incisors (not owing to lack of space; *fig. 3*). If, later in life, lack of space develops, these teeth are affected first. They then lie mostly orally from the other teeth, and also are turned. Central and lateral incisors on each side lie first in a common bony alveolus (*fig. 4*), indicating close relationship in development. The wide shape (*fig. 5*), and regular arrangement of the germs of deciduous teeth, without lack of space and without torsion, is an expression of undisturbed intrauterine development, and of harmony between growth of teeth and jaw bone. (See illustrations on page 221.)

68. SPECIAL FORM OF PARADENTAL ABSCESS

Harry Sicher, M.D., First Anatomical Institute (Director Prof. Dr. F. Tandler), University of Vienna, Vienna, Austria

The symptomatology of so-called paradental abscesses is generally uniform. But there is one locus where anatomical features produce misleading symptoms. When such an abscess develops on the distal face of an upper wisdom-tooth, it infiltrates the thick and dense submucous tissue covering the alveolar tubercle. The patient suffers from very severe pains, mostly inaccurately localized, but inspection of the mouth reveals no visible alteration. The least infiltration—yet invisible—of this dense texture causes very severe pains. Swelling to any considerable degree is prevented by the density of the connective tissue. Conditions of the soft palate, with its muscles, often cause difficulty in swallowing. The most interesting symptom in a majority of cases is inability to open the mouth to a normal degree, owing to an anatomical detail at the origin of the inner pterygoid muscle. The largest part of this muscle is attached to the inner surface of the outer pterygoid lamina, but one bundle of fibres always originates from the outer surface of the same process, superimposed over the fibres of the outer pterygoid muscle. Although the upper insertion of the inner pterygoid muscle is generally protected against injury, this bundle may be penetrated by infiltration originating from inflammation of the gum-pocket on the distal face of an upper wisdom-tooth. It is very important to note that even this would be impossible were there not, on the same spot, an interruption in the line of origin of the buccinator mus-

cle. The transgression of this origin, from alveolar process to pterygomandibular raphe, is formed by a short ligament extending from the rear end of the alveolar process to the under surface of the pyramidal process of the palatal bone. So one finds, "on the right spot" so to say, a little hole in the back muscular wall of the oral cavity that explains the inflammation of one masticatory muscle and the muscular ankylosis.

These three symptoms, namely, (1) severe pains, (2) inability to swallow, and (3) inability to open the mouth as freely as normally, are generally connected with so-called "dentitio difficilis" of a *lower* wisdom-tooth, i.e., with inflammation of the pocket of an impacted lower third molar. It seems most important to realize that an upper wisdom-tooth—or an upper *second* molar, if the wisdom tooth is not developed—may also cause almost the same symptoms. If one knows this complex, the diagnosis can be determined by pressure against the little tubercle back of the third molar. The whole process can be abbreviated by making an incision beginning from the margin of the gum, back of the last upper molar, and following the height of the gum on the alveolar tubercle.

69. HEREDITY IN DENTISTRY

Richard Trauner, M.D., Vienna, Austria

The author discusses briefly theoretical foundations of a common inheritance for different parts of the body, including correlated congenital defects of hair, nails, teeth, etc. The data indicate a hereditary process in the development of teeth and all appendages of the skin. While this hereditary factor is identical for teeth and other ectodermal organs, dentin, the mesodermal part of teeth, shows changes in its cells and structure analogous to those in bone in the syndrome of osteogenesis imperfecta and related hereditary illnesses. Here a hereditary process in the development of these highly differentiated mesodermal tissues is disturbed. With cleft palate and hare lip there are sometimes inherited congenital fistulas in the lower lip. Accordingly, the intra-uterine development of upper and lower lips depends upon the same factor. Other observations point to a plan of human hereditary factors that is as definite as that for the histological and physio-

logical formations in the body. The paper terminates in a short review of the solved problems and open questions in the heredity of teeth and jaws. (Published in *Zeitschrift für Stomatologie*, 1933, xxxi, p. 283.)

70. ACTION OF VITAMIN D, BY LOCAL APPLICATION, IN DENTAL CAVITIES

Josef Weinmann, M.D., Histological Laboratory (Director Dr. B. Gottlieb), Dental Institute (Director Prof. Dr. H. Pichler), University of Vienna, Vienna, Austria

The author studied experimentally the local action of vitamin D (Calciferol) in teeth in dogs. Cavities were prepared without exposing pulps. Crystalline vitamin D was placed on the floor of the cavities, which were then sealed with cement (*fig. 6*). A new layer of secondary dentin was produced in each tooth in three months. The new secondary dentin shows over-calcification, as indicated by the deeply stained line within this layer (*fig. 6*). Pulps and odontoblastic cells were vital. Vitamin D, given *per os* to rats, produces over-calcification of all hard tissues. The present experiment shows that vitamin D also causes over-calcification by *local* application. Additional experiments will have to be made before final conclusions can be drawn.

71. CONTRIBUTION TO KNOWLEDGE OF DENTINAL FIBRILS

H. Wolf, M.D., Histological Laboratory (Director Prof. Dr. Gottlieb), Dental Institute (Director Prof. Dr. Pichler), University of Vienna, Vienna, Austria

A malformed lower third-molar, decalcified in the usual way, was included in histological studies of odontomata. A maze of hair-like fibres was seen in the margins of some sections. *Fig. 7* shows the junction between dentin and stratum of the odontoblasts, some displaced dentinal fibrils crossing the fissure. *Fig. 8* ($\times$ 1700) shows isolated Tomes fibres pulled out from the dentin. Tomes' fibril, not Neumann's sheath, resisted the marked decalcification. Cross sections of dentinal tubuli and Tomes fibres (*fig. 9*) are surrounded by light areas caused by processes of decomposition in the dentin matrix. That decomposition at these points is specially advanced may be due to the disposition of the argyrophile tissue; but it is possible also that the system of canals specially favored afflux of acid.

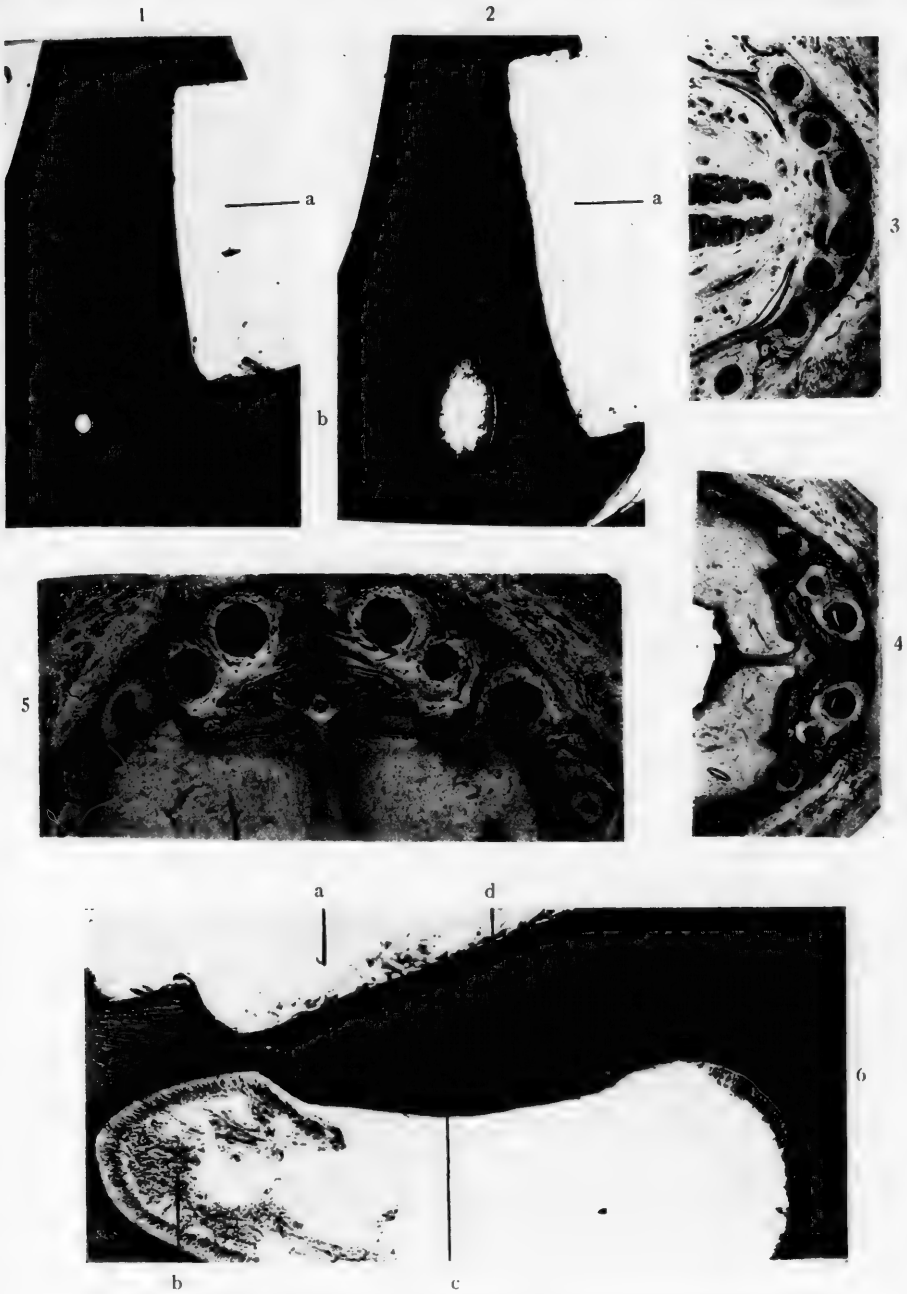


FIG. 1. Section of cavity filled for five months with 2 percent paraformaldehyde mixed with zinc oxide. *a*—Cavity. *b*—Secondary dentin almost filling pulp chamber.

FIG. 2. Section of cavity filled for five months with amalgam. *a*—Cavity. *b*—Pulp chamber showing no secondary dentin.

FIG. 3. Position of germs of deciduous teeth at birth. Note spacing.

FIG. 4. Position of germs of deciduous teeth at birth. Note common bony alveolus for central and lateral incisors.

FIG. 5. Position of germs of deciduous teeth at birth. Note wide shape, and regularity of arrangement of germs.

FIG. 6. Section of cavity showing action of vitamin D (Calciferol) by local application. *a*—Cavity. *b*—Pulp. *c*—Secondary dentin. *d*—Overcalcified dentin.

FIG. 7. Malformed lower third molar; decalcified. Shows junction between dentin and stratum of odontoblasts, and displaced dentinal fibers.

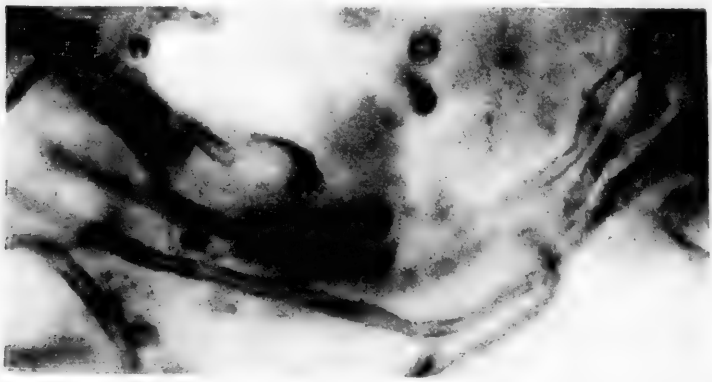


FIG. 8. Malformed lower third molar; decalcified. Shows isolated Tomes fibers pulled out of dentin. × 1700.

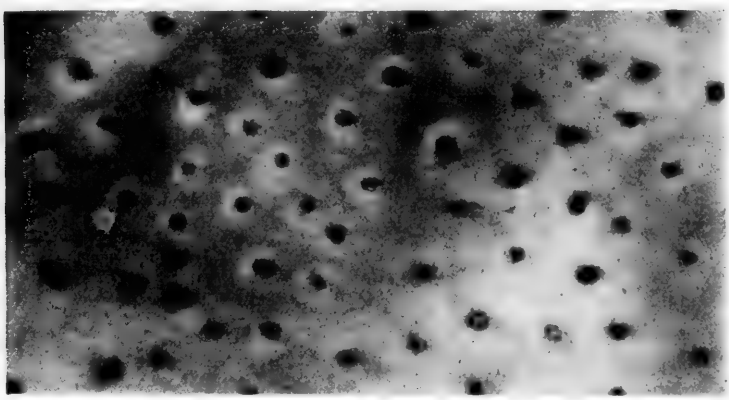


FIG. 9. Malformed lower third molar; decalcified. Shows cross sections of dentinal tubuli and Tomes fibers; surrounded by light areas, caused by processes of decomposition in dentinal matrix.

B. Contributions by Members and Invited Participants Who did not Expect to Attend the Meeting: Abstracts 72–115

72. INFLUENCE OF FLUORINE ON TEETH OF RATS

W. D. Armstrong, Sc.M., Ph.D., Medical School, University of Minnesota, Minneapolis, Minn.

For six weeks growing albino rats ingested adequate diet containing 0.1 percent of NaF, and daily received four drops of 10 D cod-liver oil. Growth rate and food consumption did not vary significantly from those of controls. The upper incisors lost their orange color after three weeks, but thereafter suffered no alteration excepting slight increase in length. Previous workers reported that rats given 0.1 percent of NaF, without added cod-liver oil, suffered decreased growth rate and food consumption and that marked tooth alterations, with pitting and corrosion, occurred after 1–2 weeks. For three weeks a second group of rats ingested the F-containing food, and then were placed on the same diet containing no added F. During the three weeks that have since elapsed, the upper incisors have broken off near the gum margin. These animals have been replaced on the F-containing food. Further work may show that an optimum amount of F in the diet causes development of harder teeth. The animals will be sacrificed at maturity, and their teeth and bones examined histologically and chemically.

73. FORM AND DIMENSIONS OF PALATE IN THE NEW-BORN

M. F. Ashley-Montagu, Ph.D., College of Dentistry, New York University, New York City

Stone casts of palates of ninety new-born children are described from anatomical and anthropometric viewpoints. Certain constant anatomic features are for the first time recognized and described. The mensurative findings are given in *Table 1*, on the next page. (To be published in *Journal of Dental Research.*)

74. SCIENTIFIC METHOD

M. F. Ashley-Montagu, Ph.D., College of Dentistry, New York University, New York City

Formal methods of science are described in an elementary manner, with particular reference to problems of dentistry, together with brief

analyses of statistical methods. (To be published in *Journal of Dental Research.*)

TABLE 1

Average dimensions of palate in new-born

NUMBER OF CASES FROM WHICH CALCULATED	CHARACTER	AVERAGE VALUE	STANDARD DEVIATION	TYPE
78	Age in days	3.7	2.8	
90	Body weight in grams	3315.0	539.5	
78	Sitting height	332.0	17.5	
78	Nasion-prosthion height	31.0	1.4	
82	Anterior palatal breadth	25.5	1.5	
90	Maximum palatal breadth	30.6	1.5	
90	Posterior palatal breadth	25.5	1.2	
90	Maximum palatal length	25.5	1.6	
82	Anterior palatal length	6.9	2.5	
82	Middle palatal length	7.4	2.9	
82	Posterior palatal length	11.3	2.8	
90	Distance of maximum palatal breadth; chord from incisivum	14.3	1.3	
90	Palatal height	7.5	2.0	
90	Distance of maximum palatal height; point from incisivum	15.1	2.1	
82	Distance of lateral sulcus point from incisivum; right side	14.4	1.1	
	left side	14.4	1.1	
Indices				
90	Palatal index	119.9	6.7	Brachyuranic
90	Palatal height index	24.8	2.3	Tapeinostaphylic
83	Anterior palatal arch index	27.4	3.6	Cycloform

75. NITROUS-OXYGEN-SOMNOFORM SYNERGISTIC ANESTHESIA

E. Roy Bier, L.D.S., D.D.C., D.D.S., Winnipeg, Manitoba, Canada

This paper describes recent researches and advances in administration, and in convenient means of prolonging safety of anesthetic range with greater muscular relaxation, allowing more freedom for better operative technique with less haste and mental strain. Reactions have been favorable. Absorption of the anesthetic mixtures is rapid, and alertness by the anesthetist is necessary to determine normal and abnormal symptoms. (To be published in *Current Researches in Anesthesia and Analgesia.*)

76. RELATIONSHIP OF ENDOCRINE EXTRACTS TO PRODUCTION OF DENTAL CARIES. I. EFFECTS OF PARATHORMONE ON DENTITION OF RATS ON NORMAL OR DEFICIENT DIETS

S. N. Blackberg, B.S., Ph.D., and J. D. Berke, D.D.S., Schools of Medicine and Dentistry, Columbia University, New York City

In earlier experiments the authors observed high caries incidence in young animals on rachitogenic diets, and in adult animals in which Ca-P metabolism was disturbed. When calcium mobilizers, such as excessive amounts of viosterol, were administered there occurred decalcification of osseous structures, and every animal so treated developed dental caries. In the present work the effect of other calcium mobilizers, such as parathormone, was determined with thirty-six rats, four weeks old, divided into three equal groups, one receiving high-Ca low-P diet; another, high-P low-Ca diet; the third, adequate control diet. In each group, half also received daily injections of 0.1 to 0.2 unit of parathormone per 20 grams of body weight; the rest, receiving no injections, served as controls. After two weeks, one from each group (injected and non-injected) was sacrificed; the rest, after 150 days. Observed lesions resembled those previously noted by the authors in animals having disturbed Ca-P metabolism. Parathormone in each case seemed to accentuate pulpal reactions. Controls on normal diets showed no carious lesions. A third of the number on normal diet, plus parathormone injections, developed caries.

References to related previous work by the authors, in volume XII of the *Journal of Dental Research* (1932): Effects of ante-natal and post-natal deficiency of vitamin D on animal dentition, p. 349. Dental caries experimentally produced in the rat, p. 609. Post-eruptive changes in the permanent dentition of dogs fed rachitogenic diets, p. 695. Histopathologic and radiographic studies of teeth of dogs on a rachitogenic diet (to be published in an early issue).

77. RÔLE OF Ca AND P METABOLISM IN PRODUCTION OF PERIODONTAL DISEASE

S. N. Blackberg, B.S., Ph.D., and J. D. Berke, D.D.S., Schools of Medicine and Dentistry, Columbia University, New York City

Previous experiments (see abstract 76) demonstrated definite relationship between disturbances in Ca-P metabolism and development

of dental caries, in animals that received diets of various types of Ca-P imbalance, with and without administration of Ca mobilizers, such as parathormone, and excessive amounts of viosterol. In the same animals, periodontal lesions were histologically identical with human varieties. Normal controls were studied in each case. Structures affected include gingiva, peridental membrane, alveolar bone, cementum, and dentin, the several types of lesions resembling those seen in man. Each variety seemed to be associated with a distinct etiology, whether systemic or local, but all started with epithelial proliferation. The controls showed no lesions when local traumatism was absent. (To be published in *Journal of Dental Research.*)

78. RELATION BETWEEN SHAPE OF OCCLUSAL SURFACES OF MOLARS AND PREVALENCE OF DECAY

Walter A. Bossert, D.D.S., Dental Division, Metropolitan Life Insurance Company, New York City

The simplest physical characteristic of the occlusal surface of a tooth that has been associated with liability to decay is conformation of enamel at the union of cusps. Does angle or inclination of surfaces of cusps have any bearing on this relation? Measurements of models of upper right first permanent molars, in 100 representative cases, accurate to 0.1 mm., were made with a Stanton Surveyer, angles of mesio-occlusal valleys determined, and caries of these areas recorded. Ratio of depth to breadth of mesio-occlusal valleys, defined as index number, R, was used as a variable against which frequency of caries was displayed. Values of R ranged between 0.17 and 0.74. To determine relative frequency of caries, in terms of R, observed cases were divided into four groups of 25, and frequency of caries computed for each group. It was shown that of teeth having shallowest valleys, only 20 percent had caries; whereas for those having deepest valleys, the percentage was 60. Incidence of caries for the intermediate quartiles was 26 and 46 percent, respectively. (Published in *Journal of Dental Research*, 1933, xiii, p. 125; April.)

79. FURTHER STUDIES IN ETIOLOGY AND CONTROL OF DENTAL CARIES

Ralph H. Brodsky, D.M.D., and Ludwig Schoenthal, M.D., Cornell University Medical College, New York Nursery and Child's Hospital, and Heckscher Foundation Dental Clinics, New York City

In previous reports the authors demonstrated influences of various factors concerned with causation or control of dental caries in a group of 319 children. It was found, during second and third years of study (present report) that 110 children receiving good diet, with or without Viosterol, developed one cavity per child during a period of twenty months, and that 14 children receiving a poor diet, to which Viosterol had been added, manifested the same number of cavities. In contradistinction, 21 children on poor diet developed approximately four cavities per child. The teeth of these children were examined again after careful dietary control was no longer maintained. Some in the good-diet group had originally received poor diets; many controls had originally received good diets. Of 84 children examined, 59 received a good diet; 25, a poor diet. During a period of one year, the former group developed 0.66 cavity per child; the latter, 1.44 cavities. These data corroborated previous observations. (To be published in *Journal of Dental Research.*)

80. METHOD TO DETERMINE EFFECTS OF VARIOUS TYPES OF TOOTH PASTE ON STAIN DEPOSITS ON HUMAN TEETH

J. T. Cohen, D.D.S., and A. C. Taye, D.D.S., Dental School, University of Minnesota, Minneapolis, Minn.

The authors aimed to determine the value of regular use of dentifrices in inhibiting stain deposits, and which type is most effective. Five types were used in which these qualities predominated respectively: soap, milk of magnesia, acid, galactonic lactone, and polishing agent unaccompanied by chemical agents. All children from an orphan home and all from a public school—223 in all, ranging in age from 3 to 15 years—were subjects. Each mouth was thoroughly examined independently by two different examiners, and amounts of stain graded as

being 0, 1, 2, 3, or 4; 0 meaning no stain, 4 meaning much stain; 1, 2, and 3 indicating equal degrees between extremes. Each child was given a prophylaxis. They were then divided into five equal groups made as nearly alike as possible in sex, and amount and type of stain. Principal and nurse at the school, and supervisor and nurse at the home, distributed new brushes and tooth paste, and personally made certain that each child had daily at least one thorough supervised brushing. The children were placed in various tooth-paste groups without the dental examiner's knowing the type of dentifrice any child was using. Each child will be re-examined after a 4-month period; and accumulated stain, if any, graded as before. In the second examination, to obtain findings uninfluenced by opinions or possible prejudices, the dental examiners will continue ignorant of the dentifrice groups to which individual pupils belong.

TABLE 2

Data on correlation between mouth conditions and scholastic standing

SCHOLASTIC STANDING	MOUTH CONDITIONS				TOTAL NUMBER
	Combined excellent and good		Combined fair and poor		
	Number	Per cent	Number	Per cent	
Excellent	39	70	17	30	56
Poor	30	51	29	49	59
Control	28	57	21	43	49
Total	97	59 (av.)	67	41 (av.)	164

81. GENERAL MOUTH CONDITION AND SCHOLASTIC STANDING

Joseph T. Cohen, D.D.S., Dental School, University of Minnesota, Minneapolis, Minn.

Fones and Sutton found that the number of failures in schools under their jurisdiction dropped perceptibly after the mouths of the children were placed in healthy condition. The author sought to determine what relationship, if any, existed between general mouth condition and scholastic standing of junior high school boys (164), in three groups: one (56), the best pupils; another (59), the worst—49 pupils, representing various types, were controls. The mean age was 14 years 8 months. The groups were mixed for dental examinations, which were

made without the examiner's knowledge of any scholastic standings. All teeth were charted; size of cavities and fillings noted; oral hygiene, gum condition, and degree of malocclusion if any, recorded. Mouths were then graded by two examiners as being excellent, good, fair, or poor. After completing examinations and grading all mouths, scholastic standings were charted against mouth conditions. The data in *Table 2* show that of the best students 70 percent, of the poor students 51 percent, and of the control group 57 percent, had either excellent or good mouths. The number of pupils was small, but the tendency suggests a relationship between mouth condition and scholastic standing.

82. CAUSES AND PREVENTION OF TWO TYPES OF POROSITY IN DENTAL CASTINGS

William H. Crawford, D.D.S., Dental School, Columbia University, New York City

Porosity in dental castings may be divided into two general types: (1) Porosity caused by occlusion of gases, formation of oxides, and trapping of air and débris, such as pieces of investment, during the process; characterized by regular shape and even distribution; preventable largely by proper selection of casting alloys, proper fluxing during melting, care in melting, and care and cleanliness during the process. (2) Porosity due to shrinkage during freezing of the alloy; characterized by irregular or negative dendritic form; generally localized in portions that freeze last; best avoided by proper selection of sprues as to length, diameter, and shape, as demonstrated by microscopic examination of polished sections of castings in which the only intentional variables were size, length, and shape of sprue. Effects of porosity are loss of strength, and tendency toward discoloration, of a casting in service.

83. COMPENSATION FOR GOLD CONTRACTION IN CASTINGS FOR VARIOUS TYPES OF CAVITY PREPARATION

William H. Crawford, D.D.S., Dental School, Columbia University, New York City

The author sought to obtain data showing proper compensation for contraction in casting gold restorations for various types of cavity

preparations. Many castings were made for practical cases, conditions having been carefully controlled and records kept as follows: (1) Type and shape of cavity, including one-, two-, and three-surface inlays, three-quarter veneer-crowns on anterior and posterior teeth, and full crowns. Of each, many modifications were presented, from very thick to very thin occlusal surfaces; heavy boxes on one side of tooth and small boxes on opposite side; and long, parallel, medial, and distal extensions toward gingival to very short converging extensions. (2) Method for securing wax pattern, whether by direct method, indirect, or combination of two. Where indirect method was employed, records were kept on compound used in impression and amalgam used in making model. (3) Type of wax used by operator. (4) Setting and thermal expansions of investment used in making casting. (5) Temperature of investment at time of casting. (6) Result, including surface secured on casting and manner in which casting fit tooth. Results showed that castings of various types require different amounts of expansion to compensate for gold contraction. Using a single investment technic, castings made for two-surface inlays, three-quarter veneer-crowns on anterior teeth, and other castings where walls were short and converging toward the occlusal, required a compensation for gold contraction of between 1.0 and 1.1 percent for most satisfactory results. Castings for three-surface inlays, full crowns, three-quarter veneer-crowns, one-surface inlays, and backings for porcelain facings, require a compensation for gold contraction of between 1.3 and 1.4 percent. Among other points of interest were effect of setting expansion of the investment, wax expansion, temperatures of wax and compound in the mouth, and space between inlay and tooth in uncemented and cemented restorations.

84. EFFECTS OF HEAT ON STRENGTH AND DUCTILITY IN WROUGHT-GOLD ALLOYS

William H. Crawford, D.D.S., Dental School, Columbia University, New York City

Wrought-gold wires were studied relative to strength and ductility properties when heated to temperatures corresponding to those used in construction of appliances. Physical properties of many alloys on

the market appear to be satisfactory, but in clinical practice there are difficulties after soldering operations, noticeably in loss of strength and ductility. Wires were heated under controlled conditions to temperatures corresponding to those to which the wires would be subjected during soldering operations. There was general loss in strength of 20 percent or more. The higher the wires were heated, the greater the loss in strength. Regardless of subsequent heat treatment, wires were weakest at or near the solder joint, usually the point of greatest stress. Linked with loss in strength caused by high temperature is general loss in ductility, especially when wires have been subjected to a hardening heat-treatment. Frequently, wires became very brittle when subjected to slow cooling, whether intentional or accidental, after having been heated to soldering temperatures. The author feels that breakage at or near solder joints is caused to a large extent by combination of these two factors. Studies were also made of types of union between solder and wire, which may vary from an entirely mechanical union to one in which integrity of the wire is lost, and solder completely alloyed with it.

85. PHYSICAL PROPERTIES OF DENTAL CEMENTS

William H. Crawford, D.D.S., Dental School, Columbia University, New York City

Dental cements were investigated to determine their physical properties and relative values. Tests indicated that adhesiveness is nonexistent in set cement. Specimens of cement, stored for different lengths of time and in various media, reached practically the same crushing strength, but some were very weak. Temperature of mixing slab, proportion of liquid and powder, and length of time consumed in incorporating powder into liquid, have effects on ultimate compressive strength and rapidity with which cement sets. Probably the most interesting result was the finding that the same consistency and approximately the same strength may be secured by incorporating *slowly* a smaller amount of powder in a given amount of liquid as by incorporating *rapidly* a larger amount of powder in the same amount of liquid.

86. FACIAL HEIGHT AND DENTAL LENGTH

Kent K. Cross, D.D.S., A.M., F.I.C.D., University of Denver, Denver, Colo.

Fifty students—25 male and 25 female, average age 20.5, University of Denver—were measured as to total face, upper face, lower face, dental (interalveolar), nasal, and ramus heights. Total face approximated that taken in New York by Hellman, but the author noted a stronger jaw; Hellman, a more prominent upper face. Measurements of soft tissues by different operators may in part account for this difference. Growth of teeth not only affects depth of face, but increases facial height, if occlusion is normal, to approximately the length of the maxillary central incisor. This dental length may be greatly reduced in that form of occlusion called abnormal overbite. In both Eastern and Western groups, dental length was the only measurement in which women exceeded men. In the Eastern group, upper face and total face-length, and nasal height, were greater. In the Western group, lower face and ramus-auricular height were greater. The Western group was probably more purely Nordic; the Eastern, more cosmopolitan or composite. The ascending phase of facial length, from infancy to young adulthood, is of special interest to the orthodontist; the descending phase, from young adulthood to senility, is a problem primarily for the prosthodontist.

87. STUDIES ON POLICIES OF ADMISSION AND PROMOTION IN DENTAL SCHOOLS

Frank H. Cushman, B.S., D.M.D., F.A.C.D., Dental School, Harvard University, Boston, Mass.

It has been found that, at Harvard, levels of accomplishment were on the whole consistent and tended to be reached early, and that neither repetition nor any other form of disciplinary action was markedly successful in improving quality in the student's work. This finding indicated that a quality product was obtainable more frequently by careful pre-selection of students for dentistry, in accordance with experience of educators in other lines. On comparing a student's previous scholastic record with his attainments in various aspects of dentistry, the most definite index appeared to be his marks in college sciences. Of those presenting averages of A or B in college sciences,

over 60 percent were superior dental students and only 2.5 percent were subject to any form of adverse faculty action. Of the D group in college sciences, less than 15 percent were superior students of dentistry, and 96 percent had to meet some form of adverse faculty action. While admitting the fallacy of selecting students solely on the basis of scholastic marks, the paper points the way for more detailed studies of aptitude and attitude as criteria for more economically meeting public needs in oral health service.

88. LATENT SCURVY AND ITS RELATION TO DENTAL DEFECTS

C. D. M. Day, B.D.S., D.M.D., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

This investigation into effects, upon teeth of guinea pigs, of partial lack of antiscorbutic seems to support the contention that scurvy, at least in its latent or subacute form, is much more common than generally supposed. In spite of absence of clinical manifestations, and with sometimes a negative scurvy-score at autopsy, pronounced and often striking changes occurred in the tooth structure. Calcification of dentine was unimpaired on 5 cc. of tomato juice daily over an experimental period of 60 days, while marked abnormalities were observed on dosages of 4 cc. or less. Significant structural differences occurred with small variations in dosage. Histological evidence indicates that canned tomato-juice confers approximately the same degree of protection as fresh juice. In view of the similarity in effects of the disease in guinea pig and man, it may be safely assumed that small deficiencies in vitamin C causes similar changes during tooth-forming periods in infants and adolescents. (To be published in *Journal of Dental Research.*)

89. PREVENTION AND CONTROL OF DENTAL CARIES IN PREGNANT MOTHERS

Charles L. Drain, D.D.S., E. D. Plass, M.D., and W. Fred Oberst, Ph.D., College of Dentistry, State University of Iowa, Iowa City, Iowa

Five primigravidas were studied during the last twenty weeks of gestation; three, postpartum. One subject was diabetic; one was luetic; three were apparently normal. The patients were housed in a comfortable ward, isolated from other hospital patients, and super-

vised continually by a graduate nurse. Environment approximated that in their own homes. A preliminary general physical examination and dental survey were made on each patient; the dental record was compiled by two independent examiners. Cavities originally recorded were left open to all extraneous influences. No dental restorative work was done, but at the beginning each subject was given prophylactic treatment. Mouth examinations were usually made every four weeks. At the outset, active dental caries was present in all five women, destruction varying as in any similar unselected group. Consistent improvement in dental condition was noted over the entire period of nearly five months, but in only one case was complete arrest of caries observed. Metabolism of Ca, P, and N was also studied—complete determinations on 10-day collections each month. Positive balances were obtained in all periods, excepting for one subject at delivery, when a negative balance is easily explained. Diet was basically like that in previous work on children.[8] While no definite conclusions can be drawn, suggestions for future work are indicated: (1) Maintenance of positive balances of Ca, P, and N during the last half of pregnancy, hand-in-hand with consistent improvement in dental conditions, may be merely coincidental or of great importance. (2) If positive mineral balances are important in control of dental caries in pregnant women, it would seem easier, other conditions being equal, to maintain balances by regulating diet during early months of gestation, thereby building up Ca-P reserves in bony structures for use in later months, when demand for fetal growth is greatest. (3) The patient in whom arrest of caries was observed had the best dental condition at the beginning. (4) These observations suggest that, by adequate dietary regulation, prospective mothers may be protected against severe destruction and loss of teeth in pregnancy.

90. INTRAVENOUS ANESTHESIA AS APPLIED TO EXCEPTIONAL CASES IN ORAL SURGERY

A. G. Dujat, M.D., C.M., and S. W. A. Franken, D.D.S., F.I.C.D., Lenox Hill Hospital, New York City

The advantages of the procedure are (1) speed and ease of induction; (2) speed of post-operative awakening; (3) absence of post-operative

[8] Drain and Boyd: *Journal of the American Medical Association*, 1928, xc, p. 1867; *Journal of the American Dental Association*, 1930, xvii, p. 738.

nausea and vomiting; (4) use in that definite group of oral surgical cases where local anesthesia is contraindicated and general anesthesia too dangerous; also in such cases as infective cellulitis involving the epiglottis, or infected mouths complicated with pulmonary abscess. Several case histories illustrate this anesthesia as given to such patients.

91. RECENT BIOLOGIC STUDIES OF HUMAN TEETH

Guido Fischer, M.D., Dental Institute, University of Hamburg, Hamburg, Germany

Based upon many years of clinical experience and histologic study of intact and carious teeth, the author concludes that (1) since pulp is irritated even when caries is confined to enamel, and since initial caries in dentin frequently leads to infectious foci in pulp, the entire operative procedure of filling teeth must be altered and rebuilt on another basis, i.e., an aseptic technic, and use of non-irritant drugs and of insulating agents below fillings to protect pulp. (2) "Clinically hard" dentin in a prepared and cleansed cavity is often infected, and leads to secondary caries; in presence of acid salts, as from silicate fillings, necrosis and gangrene of pulp may result. (3) Root-canal therapy, as usually practised, hinders biologic closure of apical foramina by cementum-like tissue and dense fibrous cicatricial tissue. (4) There is nothing so menacing to pulp as hyperacidity from caries, which inexorably and ultimately causes death of pulp. (5) Whereas endogenous disturbances of metabolism lead only to stasis and alkalosis of pulp, and are therefore not menacing to its existence and function, the true enemies of living pulp are exogenous factors, i.e., acid-producing pathogenic microörganisms from dental caries. (6) A representative of *endogenous* disturbances is paradentosis (pyorrhea alveolaris); of *exogenous* disturbances, infections beginning with caries. (7) Definite antagonism exists between the two most important dental diseases: (a) caries, leading to death of pulp, and (b) paradentosis, which does not endanger pulp, in even severest stages of the disease.

92. CONDENSATION AND FIRING OF DENTAL PORCELAIN

J. R. Gill, D.D.S., Dental School, University of California, San Francisco, Calif.

A more scientific method of firing should be used than that now in vogue. The porcelain should be cooled very slowly in the furnace to

get best results. By cooling the porcelain, the particles are permitted to arrange themselves in definite formation. In slow cooling, shrinkage becomes uniform, and hard, dense and homogeneous porcelain is obtained. The author's results emphasize the need, in dentistry, for more thorough study, and a broader knowledge, of fundamentals of ceramics.

93. COLONIAL VARIATIONS OF LACTOBACILLI FROM HUMAN AND RAT MOUTHS

Samuel Greenberg, D.D.S., and Theodor Rosebury, D.D.S., Medical School, Columbia University, New York City

Colonial variations of strains of aciduric gram-positive rods from mouths of men and rats, with or without dental caries, were studied in young surface-cultures on dextrose agar. More than fifty colonial varieties were classified into fourteen types, distinguished by surface topography, marginal character, and presence or absence of central papillation or depression. There was no clear indication of natural grouping of types or of uniform dissociative trends in successive platings; no significant difference between strains from carious and non-carious human mouths, nor between those from carious and non-carious rat mouths. But strains from rats were morphologically more heterogeneous than strains from human mouths. Minute subcolony forms (Hadley's "G") were found generally after repeated successive platings. Transplants of these subcolonies to broth were not generally followed by visible growth, but filtrates of such clear broth-cultures through Berkefeld N candles, plated after prolonged incubation at room temperature, reproduced typical colonial forms in some instances.

94. MEDICO-DENTAL RESEARCH IN HAWAII

Martha R. Jones, Ph.D., Nils P. Larsen, M.D., and George P. Pritchard, D.D.S., Queen's Hospital, Honolulu, T.H.

Although Hawaii is sub-tropical and sunshine abounds, respiratory diseases are common and dental decay is endemic. Marked dental defects and a condition simulating decay of enamel have been observed in unerupted teeth of autopsy cases. Teeth of many babies are rav-

aged by decay before complete eruption. Vitamin-deficiency diseases, beriberi excepted, are rare. Diet of the laboring population consists essentially of rice, bread, and small amounts of meat, fish, eggs, fruits and vegetables. Babies are almost universally breast-fed. Researches indicated below were started in June, 1928: (a) Study of diets of various national groups, and detailed dental examination of infant and pre-school population of Oahu (reported). (b) Analyses of human blood and milk, and ash determinations on bones of autopsy cases. (c) Histologic study of bones and teeth of autopsy cases (reported). (d) Roentgenographic study of bone and tooth development of representative groups of babies. (e) Experimental plantation *health project* (present report).

Health project.—A sugar plantation with stable population of approximately 4500 persons, largely Japanese and Filipino laborers and their families, was chosen. This educational project is intended to induce the people to substitute taro and potatoes (principal carbohydrate foods of old Hawaiians) for rice and bread now used, and to increase consumption of milk, fruits, and vegetables. The medium is a "health center" in each district. The approaches are through baby, mother, expectant mother, kindergarten and school children, and adult population. Teaching is done by demonstration, animal experiments, and spectacular laboratory tests. All health activities of the plantation are coordinated with those of the health center. The more important are: (a) hospital; (b) baby clinics, at which all babies receive supplementary food daily, and are weighed, measured, examined, and their teeth charted bi-weekly; (c) pre-natal, birth control, and chest clinics; (d) special lunches for kindergarten and school children; (e) health project in kindergarten and school (total 1200 children), which includes a "health council," daily "health review" with follow-up in homes, home-making project for girls, garden project for boys, and "preventorium" classes for under-par children. In all activities emphasis is laid upon acid-base values of foods, and the dietary importance of taro, potatoes, milk, fruits, and vegetables from the standpoint of alkali content. *Progress.*—The health centers have increased to four covering the entire plantation. Enrollment of babies (voluntary) rose from 1 in April, 1930, to 210 in January, 1933. Infant mortality

dropped from 160.7 in 1929 to 25.4 in 1932. Babies, fed artificially from early infancy largely or exclusively diets prepared by health centers, are larger, stronger, and have markedly better teeth than those essentially breast-fed. In 1932 there was no case of pneumonia among babies under one year of age, and no case of diarrhea that warranted hospitalization. The entire plantation community has become food-, tooth- and health-conscious. Evidence indicates that dental decay expresses metabolic fault and that, under conditions existing in Hawaii, caries can be completely and quickly eradicated by preponderance in the diet of foods that yield alkaline ash (taro, potato, fruits, and vegetables).

95. CHEMICAL STUDIES OF ENAMEL AND DENTIN IN RELATION TO DENTAL CARIES[9]

Maxwell Karshan, M.A., Ph.D., Richard Wiener, B.S., D.D.S., and Nathan Stofsky, B.S., D.D.S., Schools of Medicine and Dentistry, Columbia University, New York City

In the proceedings a year ago (p. 523), the senior author reported that aqueous extracts of enamel and of dentin contain Ca, P, and carbonate or bicarbonate, which may be constituents (a) of the solid-phase that are soluble and present in small amounts, or (b) of fluid in enamel or dentin. Protein and Mg have also been detected in these extracts. Concentrations of constituents are maximum in the first extract and decrease in successive extracts. Ca, Mg, P, and CO_2-yielding materials are not removed in the ratio of their occurrence in enamel and dentin. Ca and Mg are not present, in extracts, in amounts large enough to account for all P and CO_2 in the phosphates and carbonates believed to constitute the solid-phase of enamel and dentin. Excesses of P as phosphate, and of CO_2 as bicarbonate or carbonate, may be present as alkali salts to constitute buffers of tooth fluid. This holds to less extent for enamel than for dentin. Studies of extracts of enamel and dentin from carious and non-carious teeth have failed to reveal correlation.

[9] Aided by a grant from the Commonwealth Fund for research in dental caries.

96. STUDIES OF VARIATION IN SALIVARY PROTEINS[10]

Frances Krasnow, A.M., Ph.D., and Edith B. Oblatt, A.B., School of Dental and Oral Surgery, Columbia University, New York City

Employing the factor, 21—ratio between tyrosine and protein—analyses were made on saliva of caries-immune and of caries-susceptible persons. Frequency curves, used to estimate incidence of values, indicate that (1) a higher salivary protein occurred more often in caries-immune individuals; (2) during the day, salivary protein of caries-susceptibles was subject to less change; (3) on centrifugation, more protein was sedimented from saliva of caries-susceptibles, suggesting that possibly salivary protein of caries-immunes is more stable. There was striking interdependence of protein, P, pH, and titratable alkalinity, in caries-susceptible cases. Incidence of low- or high-protein values varied directly with those for low- or high-P, pH, and titratable alkalinity. Under most favorable conditions for standardization of saliva-collection (i.e., morning unstimulated samples), the correlation was most marked.

97. EFFECTS OF DIETARY FLUORINE IN RATS[11]

Frances Krasnow, A.M., Ph.D., and Anna Serle, A.B., School of Dental and Oral Surgery, Columbia University, New York City

Rats—200 in eight equal groups—received adequate diets varying only in content of *F* (trace to 0.0025 percent of NaF) and viosterol. Diets containing traces of *F* and 0.0005 percent of viosterol (half minimal dose) often caused greater percentage gain in weight than the same diets having more *F*. On diets containing 0.001 percent of NaF and 0.008 percent of viosterol, rats while younger than fifteen weeks grew more rapidly than those on diets containing traces of *F*. On diets containing 0.0025 percent of NaF, *female* rats showed, after twelve weeks, greater increase in weight than female rats on rations containing no added *F*, whereas all *males* on this diet reacted like

[10] Aided by a grant from the Commonwealth Fund for research in dental caries. Presented at a meeting of the New York Section of the International Association for Dental Research, Guggenheim Dental Clinic, New York City, February 16, 1933.

[11] Footnote 10 applies also to this work.

males on diets containing 0.001 percent of NaF. After twenty-four weeks, *upper* incisors were much elongated, and edges appeared to be crumbling away. Although dark in spots where enamel was absent, there was no normal orange coloration nor translucency, but marked chalkiness instead. Lower incisal edges presented elevations resembling mamelons. Gingival tissue was badly inflamed. Rats on diets containing 0.0025 percent of NaF also showed progressive lengthening of *lower* incisors. There was no observed correlation between behavior and body-weight, and tooth formation. On diets to which *F* had not been added, there were abnormalities, such as chalkiness and elongation, that closely resembled some in rats on diets containing excess of *F*, these abnormalities having occurred regardless of content of viosterol. (All the experiments were begun with rats three weeks old; all comparisons were made for rats at the same ages.)

98. DIETARY CONTROL OF POTENTIAL BLEEDING

I. Newton Kugelmass, M.D., Ph.D., Sc.D., Fifth Avenue Hospital, New York City

Hemorrhagic status has been evaluated quantitatively in terms of the index of blood-clotting function. This represents the ratio of concentration of prothrombin, fibrinogen, and active platelets over content of antithrombin. The normal index is 0.5 ± 0.1. In standardizing this normal value, it was observed that dietary constituents affect blood coagulability. Protein and fat increase the index by accentuating coagulation; vegetables, fruits, and carbohydrates decrease the index by delaying coagulation. Prevention of chronic tendency to bleed may thus be realized by therapeutic administration of high-protein diet.

99. NEW TECHNIC FOR REMOVAL OF IMPACTED UPPER CANINE

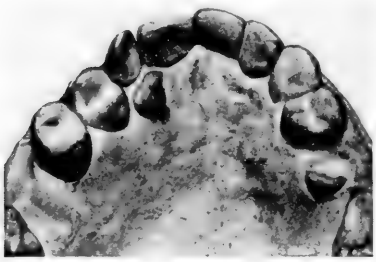
A. E. Loos, M.D., Dental Clinic, German University, Prague, Czechoslovakia

Many hesitate to remove impacted teeth so long as they are quiescent. The harm they may do indicates they should be removed as early as possible. Pressure from an impacted tooth may cause a lesion of periapical tissues of neighboring teeth (periodontitis). When an

impacted tooth moves, neighboring teeth may be dislocated, loosened, or even pushed out of the jaw. If an impacted tooth is situated just beneath the gum surface, ulceration may occur; infection of the pericoronal space may ensue; and consequent suppuration may damage pulps of neighboring teeth, endanger the antrum, and cause injuries to different organs by infection from that focus. Cysts, sometimes found around impacted teeth, may cause all damage just indicated; but an impacted tooth may also induce neuralgia, facial paralysis, nervous diseases, and neoplasms. In many cases, impacted canines are in oblique position, the crown just erupting in the palate behind the incisors, the root being beneath the vestibular surface of the alveolar process. For removal, a forceps cannot be used owing to lack of space (*fig. 10*). The tooth can be approached not only from the palatal side but also from the vestibular side of the jaw. Then bone can be removed from both root and crown of the impacted tooth, which can be dislodged by leverage. With an instrument the crown is pushed out to the palatal side. During this operation the roots of incisors are in great danger. Unless sufficient bone is removed so that the crown is entirely freed, it is impossible to luxate the crown from the palatal side. But then an enormous lesion of the bone is created, and incisors may be loosened. For these complicated cases, which are common, the author has designed an instrument (*fig. 11*) that facilitates removal of the impacted tooth in a much shorter time and without much destruction of bone.

By forming a flap of periosteum and gum, the crown of the canine is made visible. Only so much bone is removed as has been made necessary by the size of the instrument. Then the bone is removed from the root on the vestibular side of the alveolar process (*fig. 12*). With a fissure-bur, a cross section is made through the root, so that one part may be easily removed with levers. Now the hollow end of the instrument (*fig. 11*) is placed on the canine crown. Then, with a mallet, this part of the tooth, consisting of crown and little piece of root, is driven out of the jaw into the vestibulum oris. Parts of the bone above the greatest circumference of the crown give way, and the crown is passed through the narrow parts of that canal. If it should be desired to implant the extracted tooth, the bone is removed around the apex so that the latter may be tilted forward when the tooth is

driven out by the instrument. During this operation, a little piece of rubber inserted into the hollow end of the instrument prevents damage to the crown of the canine. By this procedure the lengthy operation of



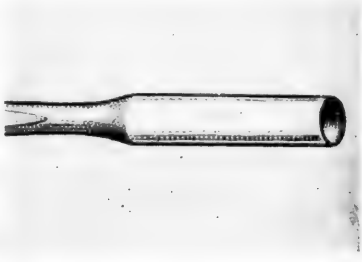


FIG. 10 FIG. 11

FIG. 10. New technic for removal of impacted upper canine. Note that forceps could not be used owing to lack of space.

FIG. 11. New technic for removal of impacted upper canine. Author's new instrument.

FIG. 12. New technic for removal of impacted upper canine. After forming flap of periosteum and gum, crown of canine is exposed and sufficient bone removed from root on vestibular side of alveolar process to permit use of instrument to drive tooth into vestibulum oris.

removing impacted canines is often shortened to ten or fifteen minutes, and even an unskilled operator can easily succeed. To get a clear view of the field of operation, the author recommends that in more

difficult cases the gum be cut corresponding to the axis of the impacted tooth up to the gum line, and the periosteum removed from the alveolar process of all neighboring teeth. The constant threat of severe damage to the whole organism by impacted teeth necessitates early removal, if surgical and orthodontic procedures combined do not eliminate the danger.

100. NUTRITIONAL CONTROL OF DENTAL CARIES IN CHILDREN OVER TWO-YEAR PERIOD

E. C. McBeath, D.D.S., B.S., B.M., M.D., Dental School, Columbia University, New York City

Dietary control of dental caries has been demonstrated in experimental and control groups of children in institutions near New York City over a two-year period (1930-32), with reversal of control and experimental groups during the second year. Some experimental groups were reduced in susceptibility nearly to zero. Basic dietary corrective principles were used. Addition of vitamin-C sources to regulation diets did not produce results of any significance for control or prevention of dental caries. Vitamin-B content of the diet was important chiefly as it affected Ca-P metabolism. The best known sources of vitamin D were apparently most protective. There was distinct variability in protection by different sources of vitamin D—quartz-mercury-lamp radiation being most effective as compared with Viosterol and cod-liver oil. From clinical observations, it is assumed that control of dental caries is definitely correlated with vitamin D and Ca-P metabolism. Results of quartz-mercury-lamp radiation compared favorably with those of protective diet. Dietary control of dental caries was short in duration after withdrawal of *protective* diets.

101. FORCES EXERTED ON HUMAN MANDIBLE BY MUSCLES OF OCCLUSION

Donald Mainland, M.D., Ch.B. (Edin.), and J. Earle Hiltz, B.Sc., Medical Faculty, Dalhousie University, Halifax, Nova Scotia

The authors determined the direction, and relative and approximately absolute amounts, of forces exerted by the muscles of occlusion—mas-

seter (superficial and deep parts), internal pterygoid, and temporal (anterior and posterior parts). The material having been limited, attention was paid to variations rather than to establishment of averages. The muscles were examined on both sides of twelve heads of embalmed dissecting-room subjects—five females and seven males; ages, 22 to 87. Routine dissection of nine heads having resulted in drying of the muscles, temporals in this set were discarded and absolute forces of other muscles were not recorded. In the other three, specially dissected and kept moist, results were comparable with those that might have been obtained from fresh specimens. Marks were made at the centers of origin and of insertion of the muscles to give the line of the central fiber, and the angle between this line and eye-ear plane was measured. Distances of origin and insertion from this plane were determined, and outward or inward tilt of the muscles was obtained by calliper measurements across the skull. Length of the central-fiber line was taken to represent total force of the muscle, and, using triangles of forces, the total was broken into components acting up, forward or backward, and inward or outward.

The force of a muscle is proportional to the area of its physiological cross-section (i.e., at right angles to all fibers); therefore each muscle was cut through in this way. The cut ends were painted with ink and imprinted on paper. Marked areas were traced on kodaloid, cut out and weighed, and weights converted to square centimeters. Total forces in the three specially prepared specimens (all males having dentition better than average) were, in kilograms: 308, 273, 283; in pounds: about 678, 601, 623. By the method of moments the forces for each muscle, acting upward and either forward or backward at the second mandibular molar, were calculated. Upward force was comparable with figures obtained by Black with the gnathodynamometer on living subjects. Further analysis of the ultimate direction of forces was not made, but tables will be published to permit all forces to be referred to other points and planes. Confidence in the method was strengthened by agreement between findings, and clinical experience and opinion. For instance, in this series, average force was decidedly greater where molar dentition was better, and in most instances forces of the right side seemed greater than those of the left. The anterior component of the total force acting at the level of the second molar

was greater than the upward component at that tooth. Total transverse pull in the three special specimens varied from about 7 kilograms outward (one side of one body) to about 11 kilograms inward (one side of another body). Direction outward or inward depends quite largely on shape and size of skull, and not only on size of muscles.

102. MANDIBULAR AND PALATINE TORI, AND THEIR ETIOLOGY

G. P. Matthews, D.M.D., F.R.M.S., Dental School, Harvard University, Boston, Mass.

Mandibular and palatine tori are not restricted to race, sex, or age. In Eskimo and Icelandic races these tori are associated with powerful masticatory musculature and teeth showing marked occlusal wear. Where jaw bones are dense or massive, these tori are small or absent; where occlusal facets indicate powerful mastication toward the median plane, the palatine torus is more frequent; where the jaws occlude with maxillary and mandibular incisors in edge to edge bite, the mandibular torus occurs oftener. These tori, brought about by physiological processes instituted in response to functional demands, are useful acquired characters, not pathological lesions. Therefore, their occurrence does not call for surgical intervention except for prosthetic reasons, or when they interfere with speech. (To be published in *Journal of Dental Research.*)

103. BIOLOGIC TREATMENT OF DENTAL PULP

Frantisek Neuwirth, M.D., State Dental Institute and Charles University, Prague, Czechoslovakia

No manuscript received for publication.

104. TREATMENT OF OSTEOMYELITIS OF MANDIBLE BY INTRAORAL MAGGOT-THERAPY

N. C. Ochsenhirt, M.S., M.D., F.A.C.S., and M.A. Komara, D.D.S., Dental School, University of Pittsburgh, Pittsburgh, Pa.

In the field of surgical diseases of the oral cavity there is probably no more difficult problem than that of osteomyelitis. These conditions usually develop high degree of chronicity and run for years, with temporary healing, only to be followed by reactivation with all its dangers

and disability. Failure of permanent healing is probably due to confinement of necrotic bone or small foci of infection, surrounded by new bone, which relight the infection from time to time. Application of maggots is preceded by operation for removal of all sequestra and devitalised bone. An impression of the involved area is then made, and a cage or denture constructed. A metal tube is embedded in the cage running from the base, where it opens into the area of bone involved, to the upper portion where it protrudes from the mouth. Maggots are applied through this tube, thus permitting direct contact with infected bone. To insure constant pressure on the apparatus, preventing escape of maggots into the oral cavity, Jelenko splints are applied to both jaws. Orthodontic rubber bands are then attached between both splints, causing firm closure of the jaws. A denture for upper and lower jaws was made for an edentulous case, and constant pressure maintained upon them with head and chin casts having adjustable side-straps. In the treatment, a cap in which 80-mesh copper-screen had been soldered is fastened over the metal tube after maggots have been applied, which is done every five days until the lesion heals. Not more than four applications of maggots were necessary in any case. To date this treatment has been used in four cases. In one, three operations had been performed over a period of six months with recurrences. The remaining cases were operated before definite sequestra had formed, all necrotic bone having been removed and maggots applied, thus saving the patient several weeks and perhaps months of prolonged disability. All these cases have remained cured with formation of smooth, normal bone.

105. ACCURATE METHOD OF MEASURING INITIAL AND FINAL SETTING-TIME OF PLASTER OF PARIS

S. G. Ritchie, B. A., D.M.D., Dental School, Dalhousie University, Halifax, N. S.

In extended study of properties of dental plasters, available methods of measuring setting points were inadequate. The method developed is simple and accurate. Using microammeter and dry cells, conductivity of the plaster is registered throughout the setting process.

Change in resistance is very marked. Resistance increases rapidly until the initial set; after a brief pause it diminishes more or less slowly, according to mix of plaster used, until the final set is reached, after which it increases slowly and steadily; eventually the current is completely blocked. This method of testing seems to confirm Davis' work indicating the change in crystallization during the setting process.

106. PRODUCTION OF TYPICAL DENTAL CARIES AND OTHER LESIONS IN RATS; PRELIMINARY STUDY OF THEIR ETIOLOGY[12]

Theodor Rosebury, D.D.S., Maxwell Karshan, M.A., Ph.D., and Genevieve Foley, M.A., Schools of Medicine and Dentistry, Columbia University, New York City

Much confusion in studies of dental caries in rats seems to be due to failure of many workers to distinguish between several varieties of tooth destruction to which rats are subject. Some of these varieties depend upon anatomical peculiarities of rat molars that have no analogue in human teeth. One such lesion begins mechanically by fracture of a defectively calcified tooth under impact of dense food-particles in mastication. Although differing in causation from fissure caries, this lesion, when fully developed, is not often distinguishable from well-developed cavities in fissure caries. Caries of molar fissures in young rats on experimental diets is very similar to caries of fissures in human molars. Such decay may be produced or prevented by altering only particle size of uncooked rice in the diet, decay occurring when cooked rice replaces uncooked rice. Physical character of some dietary ingredients determines production of dental-fissure caries in rats. These lesions may be produced on adequate diets, in presence of normal growth and health, and in teeth without appreciable structural defect; and thus are independent of dietary deficiency, and of any appreciable departure from general health. Incidence of dental caries in rats is, however, reduced on adequate diets as compared with deficient diets, but the significance of this finding is not yet clear.

[12] A report on this work was read, by invitation, at the meeting of the American College of Dentists in association with the American Association for the Advancement of Science, Atlantic City, N. J., December 30, 1932; *Journal of Dental Research*, 1933, xiii, p. 143; April.

107. ANATOMICAL PATH FOR MANDIBULAR INJECTION

H. J. Sedwick, D.D.S., School of Dentistry, University of Pittsburgh, and School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

A method is described whereby injury to anatomical structures in the region of the mandibular foramen may be avoided. If this anatomical path be followed in making mandibular injections, the lingual and mandibular nerves can be anesthetized without operative pain and post-operative soreness and stiffness, which are common when structures in this region are punctured. (To be published in *Dental Cosmos.*)

108. EFFECT OF PREGNANCY AND DEFICIENT DIETS ON RATE OF GROWTH OF RAT TEETH

H. J. Sedwick, D.D.S., and Basil G. Bibby, B.D.S., School of Medicine and Dentistry, University of Rochester, Rochester, N. Y.

The authors measured rate of growth of upper and lower incisors in female albino rats of closely approximating age and weight. The animals—90 in nine groups of ten—were subjected to various dietary conditions, and weekly measurements repeated for twenty weeks. Total growth rate of upper and lower incisors fluctuated in various weeks from 0 mm. to 6 mm. The greatest total average weekly growth (4.24 mm.) occurred in rats on kitchen scraps. Growth rates (weekly) for other groups diminished in this order: kitchen-scrap diet with pregnancies, 4.21 mm.; synthetic diet (ground yellow-corn, 76; wheat gluten, 20; calcium carbonate, 3; sodium chloride, 1), with 1 drop of cod-liver oil daily, 4.12 mm.; young rats on decreasing scrap-diet, 3.92 mm.; adult rats on decreasing scrap-diet, 3.72 mm.; synthetic diet with 0.5 drop of cod-liver oil daily, 3.65 mm.; synthetic diet with 0.75 drop of cod-liver oil daily, 3.49 mm.; synthetic diet with 0.25 drop of cod-liver oil daily, 3.48 mm.; synthetic diet without cod-liver oil, 3.55 mm. Growth rate in upper and lower incisors did not parallel one another nor total growth for both teeth.

109. TOXIC EFFECTS OF FLUORINE COMPOUNDS ON TEETH IN RATS

Margaret C. Smith, Ph.D., and Ruth M. Leverton, M.S., Agricultural Experiment Station, University of Arizona, Tucson, Ariz.

Use of F compounds as insecticides against agricultural pests is increasing. It was shown in this laboratory that 2 p.p.m. of F in drinking-water is sufficient to cause mottled enamel in children. This study reports comparative toxicity of F in different combinations, including insecticides (*fluorides* of sodium, potassium, ammonium, and calcium; *silicofluorides* of sodium, potassium, calcium, and barium; and sodium aluminum fluoride—*cryolite*), on teeth, growth rate, food intake, and general well-being of rats over a 6-week experimental period. In some experiments fluorides were incorporated in basal diet (Sherman's Diet B); in others, drinking water alone, or both food and drinking water, contained fluorides; in others, F compounds were ingested separately. *Results*: toxicity of F was uniform whether combined as sodium, potassium, or ammonium fluoride, or as sodium, calcium, or barium silicofluoride. In each case, added F equal to 0.0007 percent, or 7.0 p.p.m., in the ration interfered with normal tooth-development. This amount is equivalent to approximately 0.1 mg. of F daily per rat. Concentration of 0.0013 percent caused stunted growth; above 0.0452 percent, death. *Calcium fluoride* was strikingly less toxic, probably because of its insolubility, addition of 3 percent of this salt failing to cause death. At low levels, soluble fluorides are approximately six times as toxic as calcium fluoride. F as sodium aluminum fluoride (cryolite) affected teeth at a concentration of 0.0014 percent of the ration. When both food and water contained added F, the toxic level was lowered approximately one-half.

110. INFLUENCE OF RAW MILK ON TEETH AND GROWTH

Evelyn Sprawson, M.C., M.R.C.S., L.R.C.P., L.D.S., London Hospital Dental School, University of London, London, England

The author's earlier work, "Preliminary investigation of the influence of raw milk on teeth and lymphoid tissue" (*Proc. Roy. Soc. Med.*, vol. xxv, March 1932), is epitomized. He produces further evidence show-

ing (1) that *raw* milk has specific effect on teeth of man, conferring considerable immunity to dental caries; also (2) that there is greater perfection of body-building properties of *raw* milk as compared with pasteurised and sterilised milk, both in man and other mammals. Degree of immunity to caries may be variable, and depends on continuance of perfection of nutriment of the individual in both antenatal and postnatal phases. Forty children brought up from 4 1/2 months on *raw* milk showed, at an average age of 4 years, no incidence of caries, although on diet rich in refined carbohydrates. (Published in *Birmingham Medical Review*, 1932, vii; Dec.)

111. HYPERPARATHYROIDISM: EFFECT ON TOOTH DEVELOPMENT

Kurt H. Thoma, D.M.D., Dental School, Harvard University, Boston, Mass.

In hyperparathyroidism extensive skeletal decalcification is a primary feature. Are teeth similarly affected? The ensuing disease is generalized osteitis fibrosa of the general skeleton. With decalcification of bones there is hypercalcemia, lowering of blood phosphorus, and marked excretion of urinary calcium. In three cases studied by the author, skull and jaws were particularly involved, oral conditions having been the patient's initial complaint. In one case a first superior molar, and first and second premolars, became available for study having been removed with a benign giant-cell tumor from a boy aged 15. Although surrounding bone showed marked evidence of osteoclasia, there was no resorption inside the teeth. Teeth present very stable deposits of calcium, since no resorption occurred in a case of hyperparathyroidism so severe as to produce blood-calcium content of 19.4 mg. per 100 cc. This agrees with findings by Aub, Baur, and Albright that bone trabeculae are the readiest sources of calcium, and also concurs with Jaffe, Bodansky, and Blair in the conclusion that labile calcium exists in regions of most active bone growth. As there is no physiological resorption and apposition in adult teeth as in bone, calcium salts are not readily available in teeth for resorption. It is therefore unlikely that in nutritional disease (avitaminosis) decalcification is produced sufficiently in adult teeth to result in caries. This boy had unusually good teeth; there were no cavities, and practically

no fillings. Microscopic examination showed interrupted tooth-development that produced defects in dentine, seen as deeply staining contour-lines in premolars, roots of which were in formative stages during the active part of the disease. The first molar showed no such contour-lines, but instead there were layers of periodically deposited secondary dentine. Pulp gave evidence of edema and atrophy of odontoblasts; where odontoblasts disappeared, vacuolisation occurred; instead of secondary dentine, osteodentine was deposited. There was some lacunar resorption on the root surface, especially of the molar in contact with tissue from the giant-cell tumor. At apices there was marked hypercementosis, due to deposition of osteocementum. (To be published in *Journal of Dental Research.*)

112. IS DENTAL CARIES A NUTRITIONAL DISEASE?

Kurt H. Thoma, D.M.D., Dental School, Harvard University, Boston, Mass.

Histopathological study of dental caries in human teeth shows it is the first stage of an infectious process starting at the exposed surface of the tooth, progressing to the pulp, and ending in periapical tissue and spongiosa of the jaw. This may be spoken of as *odontitis*. Dental caries is the phase in which hard tooth substance is involved. If dental caries be a nutritional disease, caries lesions would be found in any part of the tooth, often without opening to the surface. While deficiency diseases during tooth formation cause marked disturbances in odontogenesis, resulting pathological changes are *predisposing factors only*. There is no evidence that in nutritional diseases, or in hyperparathyroidism, normally formed dentine is resorbed or decalcified. In caries the opposite occurs; in response to peripheral injury, sclerosis of dentine occurs and adventitious dentine is formed. This defensive reaction arrests the disease locally *by calcification*; does not produce it *by decalcification* from a systemic source. Deficiency diseases, however, may have important influence on defensive reactions invoked by caries lesions. In these diseases, ingestion of vitamins and P-containing foods produces beneficial results, not by correcting the etiological factor, but by strengthening or restoring the efficiency of the impaired defensive mechanism. (To be published in *Journal of Dental Research.*)

113. PROBLEMS IN MAXILLO-FACIAL RADIOGRAPHY

K. L. Vehe, B.S., M.D., Dental School, Northwestern University, Chicago, Ill.

Roentgenograms were correlated with dissections of one hundred maxillae. Special attention was given to variations in sinus floor and its tooth relations. The sinus varies in size and shape depending largely on degree of excavation of maxillary processes. Excavation of the alveolar process is most frequent and variable. The sinus floor usually begins in the region of the second bicuspid and ends distal to the third molar. Its level was inferior to the floor of the nose in 79 percent of the author's cases, and was lowest usually in the region of the second molar. Conical projections and transverse lunate ridges frequently rise 4–10 mm. above the floor. When present, they lie over the teeth; a majority, over first and second molars. Mucoperiosteum alone may cover root ends, but persistence of the lamina dura is usual. Ridges may persist after extraction of teeth. Data gathered by dissection were compared with roentgenograms, with consideration of tooth relations to sinus floor, hard palate, lateral nasal wall, facial surface of maxilla, and great palatine foramen.

114. ATTEMPTS TO DISSOCIATE CERTAIN ORAL AND DENTAL STRAINS OF LACTOBACILLI, WITH NOTES ON DIFFERENTIATION OF ROUGH VARIANTS FROM INTESTINAL LACTOBACILLI

Louis Weinstein, Ph.D., T. G. Anderson, B.A., and L. F. Rettger, Ph.D., Department of Bacteriology, Yale University, New Haven, Conn.

The authors indicate differences between recognized oral (including dental) strains and those of known intestinal origin, which do not disappear when oral strains are dissociated into RS or R types. Complete dissociation of oral and dental strains into the R form was accomplished with one organism only (dental, No. 19). R colonies of this strain closely resembled typical colonies of *L. acidophilus*, but tended constantly to revert to less rough and smooth types. In RS and R variants or dissociants of dental strain No. 19, original ability to grow in peptone broth and in carbohydrate-free media, and to de-

velop macroscopic colonies at low temperature (20–22°C.), was preserved—properties in marked contrast to those of *L. acidophilus* of strictly intestinal origin. Differences between oral and dental types are not limited to these criteria. (To be published in *Journal of Dental Research.*)

115. EXPERIMENTAL STUDY OF GINGIVAE DURING PREGNANCY

Daniel E. Ziskin, D.D.S., and S. N. Blackberg, D.V.M., Ph.D., School of Dentistry and Medicine, Columbia University, New York City

This study was prompted by observed frequency of gingival changes in pregnant women, and in other patients when sex hormones were especially active, as during menstruation or just prior to it, and in puberty. To determine whether such hormones play an etiological rôle, various sex hormones were injected into monkeys. The authors found that while irritants occur in pregnancy gingivitis, this affection is also present when irritants are absent, irritation seeming to be a complicating factor rather than a cause. Since hemorrhage often begins after onset of pregnancy, it is probably brought on by pregnancy. Epithelial changes occur in relation to month of pregnancy; hence pregnancy may be responsible for the changes. Because hyperplasia is the most notable change in the epithelium, increases with advance in pregnancy, and is also commonly present in organs of reproduction during this state, pregnancy presumably plays an etiological rôle in hyperplasia of the gums. Inflammatory changes in the submucosa cannot be linked with month of pregnancy; consequently, they are probably secondary in character. Gross changes, resembling pregnancy gingivitis, produced in monkeys by injection of sex hormones, were found microscopically to be hyperplasia of the epithelium, indicating that hormones were probably causative agents. One monkey (123) showed hyperplasia of the epithelium, without inflammatory changes in the submucosa, prompting the conviction that hyperplasia is produced by sex hormones. The authors conclude that the important gingival change in pregnancy gingivitis is hyperplasia of the epithelium, sex hormones being etiological. Dr. A. P. Stout, Associate Professor of Surgery, coöperated in the histo-pathological interpretations.

XI. Register of Officers and New Members Elected at Adjourned Meeting in New York on May 25, 1933[13]

A. OFFICERS (1933–34)

(a) Honorary: *Vice-presidents*—Jan Jesensky, Prague; Hans Pichler, Vienna; J. G. Turner, London.

(b) Active: *President*—Edward H. Hatton, Northwestern University. *President-elect*—J. L. T. Appleton, Jr., University of Pennsylvania. *Vice-president*—Theodore B. Beust, University of Louisville. *Treasurer*—Bissell B. Palmer, Fifth Avenue Hospital (N. Y.). *Secretary*—William J. Gies, Columbia University. *Trustees of the Endowment Fund*—The Treasurer (3 yr.), Arthur D. Black (2 yr.), Russell W. Bunting (1 yr.)

B. NEW MEMBERS[14]

Myron S. Aisenberg, D.D.S., Assistant Professor of Embryology and Histology, Dental School, University of Maryland

Wallace D. Armstrong, Ph.D., Instructor in Physiological Chemistry, Medical School, University of Minnesota

Louie T. Austin, D.D.S., Section on Dental Surgery, Mayo Clinic

Harry Bear, D.D.S., F.A.C.D., Dean, Dental School, Medical College of Virginia

Solon N. Blackberg, D.V.M., B.S., Ph.D., Instructor in Pharmacology, Medical School, Columbia University

Sigmund F. Bradel, B. Met. Eng., D.D.S., Assistant Professor of Crown and Bridge Prosthesis and Dental Metallurgy, Dental School, Medical College of Virginia

Cyril D. M. Day, B.D.S. (N. Z.), D.M.D., Rockefeller Fellow in Dentistry, School of Medicine and Dentistry, University of Rochester

C. Merle Dixon, D.D.S., Research Assistant, Department of Bacteriology and Pathology, Dental School, University of Michigan

Edward C. Dobbs, D.D.S., Instructor in Pharmacology and Biochemistry, Dental School, University of Maryland

[13] Lists of the members and officers as of November 15, 1932, were published in the *Journal of Dental Research*: 1932, xii, p. 998.

[14] The Association is now (June 1) composed of five national divisions and twenty-two sections. New sections have recently been organized in Richmond and Rochester (N. Y.).

Emanuel B. Fink, M.D., Ph.D., Professor of Pathology and Bacteriology, Dental School, Loyola University (Chicago)

Genevieve Foley, B.A., M.A., Assistant in Bacteriology, Medical School, Columbia University

John C. Forbes, M.A., Ph.D., Associate Professor of Chemistry, Medical College of Virginia

Samuel M. Gordon, M.S., Ph.D., Secretary, Council on Dental Therapeutics, American Dental Association

Samuel Greenberg, D.D.S., Research Associate, Department of Bacteriology, Medical School, Columbia University

Ingo W. D. Hackh, Ph.C., A.M., Professor of Chemistry, Dental School, College of Physicians and Surgeons, San Francisco

Harold C. Hodge, B.S., M.S., Ph.D., Rockefeller Fellow in Dentistry, School of Medicine and Dentistry, University of Rochester

George M. Hollenbeck, D.D.S., Medico-Dental Building, Los Angeles

Cyril H. Howkins, M.R.C.S., L.R.C.P., L.D.S., Dean, Birmingham Dental Hospital

Aleš Hrdlička, M.D., Sc.D., Curator, Division of Physical Anthropology, U. S. National Museum

Gustav Korkhaus, Dr. Med. Dent., Director, Department of Orthodontia, Dental Clinic, University of Bonn

Donald Mainland, M.B., Ch.B., D.Sc. (Edin.), Professor of Anatomy, Medical School, Dalhousie University

Herbert C. Malleson, L.R.C.P., M.R.C.S., L.D.S., Dental Surgeon, Guy's Hospital

Egon Neustadt, M.U.D., 551 Fifth Avenue, New York City

Elbert C. Pendleton, D.D.S., M.D.S., Assistant Professor of Artificial Denture Construction, Dental School, Loyola University (Chicago)

George B. Pritchard, M.R.C.S., L.R.C.P., L.D.S., Dental Surgeon, Guy's Hospital

Francisco M. Pucci, D.D.S., Dentist, National Board of Physical Education, Montevideo, Uruguay

William M. Randall, D.D.S., F.A.C.D., Professor of Prosthetic Dentistry, Dental School, University of Louisville

Adolph H. Schultz, Ph.D., Associate Professor of Physical Anthropology, Medical School, Johns Hopkins University

Edwin W. Schultz, B.A., M.D., Professor of Bacteriology and Experimental Pathology, Stanford University

H. Jobe Sedwick, D.D.S., Associate in Anatomy, School of Medicine and Dentistry, University of Rochester

Edward C. Stafne, D.D.S., Section on Dental Surgery, Mayo Clinic

Loren B. Taber, B.S., D.D.S., Instructor in Oral Pathology, Dental School, College of Physicians and Surgeons, San Francisco

Total number of new members, 32. *Total active membership (June 1, 1933)*—309.